DOE/FE-0242

Comprehensive Report to Congress:

Proposals Received in Response to the Clean Coal Technology IV Program Opportunity Notice

U.S. Department of Energy
Assistant Secretary for Fossil Energy
Washington, DC 20585

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CONTENTS

EXHIBITS

I. EXECUTIVE SUMMARY

This report is a comprehensive overview of all proposals received and the projects selected in response to the Program Opportunity Notice (PON) for Clean Coal Technology IV (CCT-IV) Demonstration Projects (solicitation number DE-PSO1-91FE62271). The Department of Energy (DOE) issued the solicitation on January 17, 1991. Through this PON, DOE solicited proposals to conduct cost shared clean coal technology projects to demonstrate innovative, energy efficient, economically competitive technologies. These technologies must be capable of (1) retrofitting, repowering or replacing existing facilities while achieving significant reductions in the emissions of sulfur dioxide (SO_2) and/or the oxides of nitrogen (NO_x) and/or (2) providing for future energy needs in an environmentally acceptable manner.

The CCT-IV PON was the fourth in a series of five solicitations being conducted by DOE as part of the CCT Program. This is a technology development program jointly funded by government and industry. It will take the best and most promising of the advanced clean coal technologies and, over the next decade, will move them into the commercial marketplace through demonstration. These demonstrations will be at a scale large enough to generate the data (from design, construction, and operation) necessary for the private sector to judge their commercial potential and to make informed commercial decisions.

CLEAN COAL TECHNOLOGY DEMONSTRATION PROGRAM

The CCT Program is developing advanced coal-based technologies that offer numerous options for addressing a wide range of energy issues, including acid rain, global climate change, improved energy efficiency, energy security, improved export opportunities, and environmental quality. Although coal's abundance makes it one of the nation's most important strategic resources in building a more secure energy future, the characteristics of coal have tended to inhibit its greater use as a fuel.

For coal to reach its full potential, environmentally responsive, economically competitive, advanced coal-using technologies and systems must be developed -- and they must be responsive to diverse energy markets and varied consumer needs.

The CCT Program in achieving the goals of the National Energy Strategy is merging technological know-how with goals for a cleaner environment and continued economic prosperity. The advanced and innovative clean coal technologies being demonstrated offer tremendous potential as part of the solution to many complex and integrated problems the nation -- and the world -- face in a rapidly changing energy and economic arena. These technological opportunities could significantly reduce or perhaps eliminate the threat of acid rain damage in the future, reduce emissions of "greenhouse gases" that are causing concern over global climate change, while at the same time creating the capability to solve the anticipated problems in meeting long-range energy requirements and promoting the export of U.S. coal and coal technology.

The program currently consists of four parts: Clean Coal Technology I (CCT-1), Innovative Clean Coal Technology II (CCT-II), Clean Coal Technology III (CCT-III) and Clean Coal Technology IV (CCT-IV). Each corresponds to a solicitation for industry proposed, cost-shared demonstration projects. A total of 8 projects comprise CCT-1. CCT-II currently has 12 projects, and CCT-III has 13 projects. Nine additional projects were recently selected under the CCT-IV solicitation -- the subject of this report.

CLEAN COAL TECHNOLOGIES

The term clean coal technology refers to a new generation of advanced coal utilization technologies that are environmentally cleaner and in many cases more efficient and less costly than conventional coal-using processes. These new energy and pollution control systems are the products of years of research and development in hundreds of government and private laboratories throughout the world. Commercial demonstration of these technologies is the final development step from the research laboratory to the marketplace. Clean coal technologies offer the potential for a cleaner environment and lower power costs by contributing to the resolution of issues related to acid rain, global climate change, future energy needs, and energy security. Clean coal technologies can reduce emissions of SO_2, NO_x, and other pollutants at three major points along the path that coal generally follows from a mine through utilization in a power plant or factory:

1. **Precombustion Stage.** Physically, chemically, or biologically cleaning the coal, i.e., removing pollutants before the coal is combusted.

2. **Combustion Stage.** Modifying the combustion process, such as staging the combustion or fluidizing and/or pressurizing the coal and ash in the combustion zone, or injecting other fuels and/or additives into the combustion zone for the purpose of capturing or breaking down pollutants.

3. **Postcombustion Stage.** Removing pollutants from the flue gases after they exit the boiler, i.e., employing cleanup devices beyond both the combustion and heat transfer sections of the power generating system.

Coal conversion represents a fourth means of using coal cleanly; it is a departure from traditional coal-burning methods in that the coal is converted into a gas or liquid that can be cleaned and then used as fuel.

Clean Coal Technologies currently being demonstrated in the CCT Program include concepts such as (1) coal preparation/upgrading (Precombustion Stage) (2) advanced combustion, atmospheric and pressurized circulating fluidized-bed combustion, pressurized fluidized-bed combustion (Combustion Stage) (3) flue gas cleanup - combined SO_2/NO_x control, flue gas cleanup - NO_x control, flue gas cleanup - SO_2 control (Postcombustion Cleaning) and (4) integrated gasification combined-cycle (IGCC) systems, mild gasification, coal liquefaction, direct coal use in ironmaking (Coal Conversion Stage).

The common thread running through the many advanced clean coal concepts is the ability to use a variety of domestic coals more efficiently while better protecting the environment. Several of these concepts have the added advantage of boosting an existing power plant's electrical output, possibly forestalling expensive investment in new power generating capacity. Many can be added in modular fashion to match more closely a utility's supply and demand requirements. Advanced clean coal technologies can offer opportunities for significantly reducing, or perhaps eliminating, the threat of acid rain damage in the future, while at the same time creating the capability to solve the anticipated problems of meeting requirements for increased power production capacity.

CONTENTS OF THIS REPORT

The subject of this *Comprehensive Report to Congress* is the response to the CCT-IV PON. Chapter II presents the CCT-IV projects selected for negotiation leading to award. It also contains an overview of the CCT-IV PON and a summary of the proposal evaluation process. Chapter III provides an overview of the technologies and the geographic locations of the proposed projects.

The environmental considerations which are an integral part of the CCT Program are explained in Chapter IV. It outlines the strategy for addressing the requirements of the National Environmental Policy Act (NEPA) as well as the strategy for monitoring and documenting the environmental performance of the demonstration projects during implementation.

Appendix A contains technical descriptions of clean coal technologies. Appendix B contains additional project information about each of the 33 proposals submitted.

II. THE CLEAN COAL TECHNOLOGY IV PON AND PROJECT SELECTION

On October 23, 1989, Public Law 101-121, "An Act Making Appropriations for the Department of the Interior and Related Agencies for the Fiscal Year Ending September 30, 1990, and for Other Purposes" was signed into law. This Act, among other things, provided funds to conduct cost-shared Clean Coal Technology (CCT) projects for the design, construction, and operation of facilities that would demonstrate the feasibility of future commercial applications of "...technologies capable of replacing, retrofitting or repowering existing facilities..." This law directed the Department of Energy to issue the fourth solicitation for the CCT Demonstration Program (i.e., CCT-IV) no later than June 1, 1990.

On May 25, 1990, Public Law 101-302 was enacted and delayed the issuance of the CCT-IV solicitation from June 1, 1990 until September 1, 1991.

On November 5, 1990, Public Law 101-512 was enacted and required that a PON be issued no later than February 1, 1991. It also required that selection of proposals occur no later than eight months after the date of the general request for proposals. Public Law 101-512 appropriated a total of $600 million for the CCT-IV projects. Of these monies, $7.2 million was programmed for the Small Business and Innovative Research Program and $25.0 million was designated for Program Direction Funds for costs incurred by DOE in implementing the CCT-IV program. The remaining, $567.8 million, was available for award under the PON. The budget is shown in Exhibit 1.

Exhibit 1

Budget for Clean Coal Technology IV

Available for Award	$ 567,800,000
SBIR	7,200,000
Program Direction	25,000,000
Total Appropriation	$ 600,000,000

On May 17, 1991, DOE received 33 proposals in response to the CCT-IV solicitation. The selection of 9 projects was announced on September 12, 1991 by the Acting Assistant Secretary for Fossil Energy. Immediately following the selection announcement, DOE officials briefed representatives of the selected projects on the negotiation process and emphasized that their full cooperation would be needed to negotiate a cooperative agreement within one year. This mandate was established by the Secretary of Energy in a directive (SEN-14-89) issued on December 15, 1989 to streamline the process used to negotiate and approve cooperative agreements.

A chronology of the major events related to the CCT-IV solicitation is listed in Exhibit 2.

Exhibit 2

Chronology of Major Events Related to the CCT-IV Solicitation

Pub. L. No. 101-121 Enacted	October 23, 1989
Designate Source Selection Official (SSO)	April 26, 1990
Pub. L. No. 101-302 Enacted (Delaying PON)	May 25, 1990
Designate Source Evaluation Board	November 1, 1990
Public Law 101-512 Enacted	November 5, 1990
Draft PON Issued for Public Comment	November 20, 1990
Public Comments Received	December 14, 1990
Final PON Issued	January 17, 1991
Preproposal Conference	February 5, 1991
First Public Meeting Held	February 13, 1990
Second Public Meeting Held	March 1, 1990
Preproposal Conference Proceedings Issued	March 4, 1991
Amendment to PON and Additional Questions and Answers Issued	May 3, 1991
Closing Date for Receipt of Proposals	May 17, 1991
Issue News Release and Public Abstracts	May 20, 1991
Selection Statement Signed by SSO	September 10, 1991
Selections Announced to Public	September 12, 1991

PUBLIC MEETINGS

DOE convened two public meetings to obtain views, comments, and recommendations on the forthcoming CCT-IV solicitation. The meetings took place in San Francisco, California on February 13, 1990 and Boston, Massachusetts on March 1, 1990. Each meeting included a plenary session during which DOE officials made introductory remarks and presented program overviews. Attendees then broke into small discussion groups to explore issues pertaining to the CCT-IV solicitation. At the conclusion of the group discussions, attendees reconvened in a closing session which included highlights and recommendations from the group discussions and a question and answer period. Published proceedings from these meetings are available.[1]

ISSUANCE OF THE CCT-IV PON

DOE issued a draft PON for public comment on November 20, 1990. Notification of its availability was published in the *Federal Register* and the *Commerce Business Daily* on November 8, 1990. DOE received 19 responses from the public. The final PON, issued on January 17, 1991, took into consideration the public comments received concerning the draft PON.

Each person or company on the Source List of the Office of Clean Coal Technology received copies of the draft and final PONs. This Source List included more than 1800 companies and organizations that had expressed an interest in the Clean Coal Technology Program. In addition to the parties who requested copies of the three previous CCT solicitations, the source list contained the names of those who responded to the *Federal Register* and *Commerce Business Daily* notices announcing the draft and final PONs for CCT-IV, and the names of those who attended the public meetings held shortly before the draft PON was issued.

To enable prospective proposers to gain a better understanding of the objectives of the CCT-IV PON, a Preproposal Conference was held in Washington, D.C. on February 5, 1991. Conference attendees were given the opportunity to submit written questions before and during the meeting. On March 4, 1991, all recipients of the PON and all Conference attendees were provided the following documents resulting from the meeting:

- Written answers to 74 questions received in connection with the PON, addressing questions received during and before the Conference;
- The Conference attendance list.

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[1] *Summary Proceedings: Public Meetings for Views and Comments on the Conduct of the 1990 Clean Coal Technology Solicitation,* Report No. DOE/FE-0171, U.S. Department of Energy, April, 1990.

On May 3, 1991, an additional set of Questions and Answers, numbered 75 through 85, was issued. Included as part of the latter mailing was a PON amendment which enabled DOE to use several staff members from one or more of the National Laboratories as Technical Advisors to review the environmental aspects of the proposals.

PROPOSALS RECEIVED

Thirty three proposals were received in response to the CCT-IV PON. The proposals exhibited substantial diversity in technologies embraced, project size and duration, geographic distribution, type of coal used, and environmental and commercialization characteristics.

THE EVALUATION PROCESS

In announcing the selection of proposals for negotiation leading to awards, the Source Selection Official (SSO), in his Selection Statement, provided an overview of the process used to evaluate the proposals received. Evaluations were performed by the Source Evaluation Board (SEB). The following description of the evaluation process is excerpted from the Selection Statement.[2]

1. PON Objective

As stated in PON Section 1.2, the objective of the CCT-IV solicitation was to solicit "proposals to conduct cost-shared Clean Coal Technology projects to demonstrate innovative, energy efficient, and economically competitive technologies. These technologies must be capable of (1) retrofitting, repowering or replacing existing facilities while achieving significant reductions in the emissions of sulfur dioxide and/or the oxides of nitrogen and/or (2) providing for future energy needs in an environmentally acceptable manner."

2. Qualification Review

The PON established seven Qualification Criteria and provided that, "In order to be considered in the Preliminary Evaluation Phase, a proposal must successfully pass Qualification." All CCT-IV proposals passed qualification review. As stated in the PON, the Qualification Criteria were as follows:

(a) The proposed demonstration project or facility must be located in the United States.

(b) The proposed demonstration project must be designed for and operated with coal(s) from mines located in the United States.

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[2]*Selection of Proposals for the Demonstration of Clean Coal Technologies; Program Opportunity Notice DE-PS01-91FE62271*, signed September 10, 1991 by the Source Selection Official, Jack S. Siegel, Deputy Assistant Secretary for Coal Technology.

(c) The proposer must agree to provide a cost share of at least 50 percent of total allowable project cost, with at least 50 percent in each of the three project phases.

(d) The proposer must have access to, and use of, the proposed site and any proposed alternate site(s) for the duration of the project.

(e) The proposed project team must be identified and firmly committed to fulfilling its proposed role in the project.

(f) The proposer agrees that, if selected, it will submit a "Repayment Plan" consistent with PON section 7.7.

(g) The proposal must be signed by a responsible official of the proposing organization authorized to contractually bind the organization to the performance of the Cooperative Agreement in its entirety.

3. Preliminary Evaluation

The PON required that a Preliminary Evaluation be performed on all proposals that successfully passed the Qualification Review. In order to be considered in the Comprehensive Evaluation phase, a proposal had to be consistent with the stated objectives of the PON, and had to contain sufficient management, technical, cost, finance, and other information to permit the Comprehensive Evaluation described in the solicitation to be performed. All proposals passed Preliminary Evaluation.

4. Comprehensive Evaluation

Proposals which passed Preliminary Evaluation were then evaluated under the Comprehensive Evaluation criteria. This comprehensive examination was performed against the criteria listed below:

Technical Evaluation Criteria

The Technical Evaluation Criteria were divided into two major categories: (1) the Demonstration Project Factors used to assess the technical feasibility and likelihood of success of the project; and (2) the Commercialization Factors used to assess the potential of the proposed technology to reduce emissions from existing facilities, as well as to meet future energy needs through the environmentally acceptable use of coal, and the cost effectiveness of the proposed technology in comparison to existing technologies.

In addition, the proposals were evaluated to identify elements of inappropriate or unnecessary scope of work in accordance with PON sections 3.37, Selection of Proposals, 4.4.4, Guide for Proposal Evaluation, and 5.3.3, Proposal Section II.C - Detailed Description of Novel Technology, which provided that proposals which contained inappropriate or unnecessary elements could be reduced in scope and concomitant costs relative to these designated elements.

The Demonstration Project Factors were as identified below:

(a) Technical Readiness;
(b) Adequacy, Appropriateness, and Relevance of Demonstration;
(c) Environmental, Health, Safety, Socioeconomic, and other Site-Related Aspects (EHSS);
(d) Technical and Management Approaches.

The Commercialization Factors were as identified below:

(a) Environmental Performance at Existing Facilities and/or While Addressing Future Energy Needs;
(b) Improved Thermal Efficiency at Existing Facilities and/or While Addressing Future Energy Needs;
(c) Commercialization Approach.

Cost and Finance Evaluation Criteria

The PON established the Cost and Finance Evaluation Criteria as follows:

(a) Commitment, and Capability to Finance the First Budget Period;
(b) Commitment and Capability to Finance the Remainder of the Project;
(c) Project Team Financial Risks.

The PON provided that the Cost Estimate was to be evaluated to determine the reasonableness of the proposed cost. Proposers were advised that this determination "will be of minimal importance to the selection," and that a detailed cost estimate would be requested after selection. Proposers were cautioned that if the total project cost estimated after selection were greater than the amount specified in the proposal, DOE would be under no obligation to provide more funding than had been requested in the proposer's Cost Sharing Plan. Other than considering the reasonableness of the cost estimate in support of the validity of the financing plan, the cost estimate was of minimal importance to the selection.

Relative Importance of the Evaluation Criteria

The PON indicated that the Technical Evaluation criteria were three times as important as the Cost and Finance Evaluation criteria. Within the Technical Evaluation, each criterion had the following weight:

Demonstration Project Factors			
Technical Readiness	20%		
Adequacy, Appropriateness, and Relevance of the Demonstration	15%		
EHSS and Other Site-Related Aspects	5%		
Technical and Management Approach and Organizational Capability	10%		
SUBTOTAL - Demonstration Project Factors		50%	
Commercialization Factors			
Environmental Performance at Existing Facilities	15%		
Environmental Performance While Addressing Future Energy Needs	15%		
Commercialization Plan	20%		
SUBTOTAL - Commercialization Factors		50%	
TOTAL			100%

During the Cost and Finance evaluation, each criterion was given the following weight:

Commitment and Capability to Finance the First Budget Period	40%
Finance Plan and Capability to Finance Remainder of the Project	40%
Project Team Financial Risk	20%
TOTAL	100%

The PON advised proposers that the evaluation would result in a numerical score for each proposal for each of the Technical Evaluation and Cost and Finance criteria. The raw score was weighted and additional credit, as detailed in the PON, was added.

Discussions with Proposers

Given the large number of proposals received and the short statutory deadline for completing the evaluations and making the selection decision, no written or oral discussions were conducted with any of the proposers.

Program Policy Factors

The proposers were advised by means of the PON that the following program policy factors could be used by the SSO to select a range of projects that would best serve program objectives:

(a) The desirability of selecting projects that collectively[3] represent a diversity of methods, technical approaches, and applications.

(b) The desirability of selecting projects in this solicitation that contribute to near term reductions in transboundary transport of pollutants by producing an aggregate net reduction in emissions of sulfur dioxide and/or the oxides of nitrogen.

(c) The desirability of selecting projects that collectively utilize a broad range of U.S. coals and are in locations which represent a diversity of EHSS, regulatory, and climatic conditions.

(d) The desirability of selecting projects in this solicitation that achieve a balance between (1) reducing emissions and transboundary pollution and (2) providing for future energy needs by the environmentally acceptable use of coal or coal-based fuels.

(e) The desirability of selecting projects that provide strategic and energy security benefits for remote, import-dependent sites, or that provide multiple fuel resource options for regions which are considerably dependent on one fuel form for total energy requirements.

[3] The word "collectively" as used in the foregoing program policy factors, was defined, in PON Section 4.5, to include projects selected in this solicitation and prior Clean Coal solicitations, as well as other ongoing demonstrations in the United States.

Other Considerations

The PON provided that in making selections, DOE would consider giving preference to projects located in states for which the rate-making bodies of those states treat the Clean Coal Technologies the same as pollution control projects or technologies. This consideration could be used as a tie breaker if, after application of the evaluation criteria and the program policy factors, two projects received identical evaluation scores and remained essentially equal in value. This consideration would not be applied if, in doing so, the regional geographic distribution of the projects selected would be altered significantly.

5. Compliance with National Environmental Policy Act

The strategy for compliance with the National Environmental Policy Act (NEPA) of 1969 that was developed for the Clean Coal Technology Program was continued in CCT-IV. It is consistent with the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Parts 1500-1508) and the DOE guidelines for compliance with NEPA (52 Fed. Reg. 47662, December 15, 1987). As part of the evaluation and selection process, this strategy resulted in the preparation and publication of a Programmatic Environmental Impact Statement (PEIS) and the SEB's written report on the project-specific environmental review of each of the 33 proposals received in response to the PON. In each case after selection, DOE is to prepare, project-specific NEPA documentation for each selected demonstration project. In addition, the NEPA strategy for CCT-IV provided that DOE would document the consideration given to environmental factors in a publicly available selection statement filed with the U.S. Environmental Protection Agency (EPA). This requirement has been fulfilled.

Programmatic Environmental Impact Statement

On November 3, 1989, DOE issued *Clean Coal Technology Demonstration Program: Final Programmatic Environmental Impact Statement,* (DOE/EIS-0146). The EPA announced the availability of this document in a notice published in the *Federal Register* on November 14, 1989 (54 Fed. Reg. 47127). The Record of Decision approving the PEIS was published in the *Federal Register* on December 14, 1989 (54 Fed. Reg. 51313).

The proposed action evaluated in the PEIS was the selection of projects proposed under the Clean Coal Technology Demonstration Program. The PEIS analysis included an evaluation of environmental consequences of widespread commercialization of successfully demonstrated Clean Coal Technologies. As a result of selections made under this round of CCT, it was clear that the technology categories analyzed and the evaluation of the environmental consequences reflected the continued applicability of the PEIS.

CCT-IV Pre-Selection Project-Specific Environmental Review

The second element of the NEPA strategy that was implemented and made available to the SSO was the SEB's report, "Clean Coal Technology IV Pre-Selection Project-Specific Environmental Review." This report evaluated the specific environmental, health, safety, and socioeconomic (EHSS) effects associated with each of the proposed demonstration projects. The SEB's report summarized the strengths and weaknesses of each proposal relative to the EHSS criteria, discussed any available alternate sites and/or processes, and described potential environmental impacts, mitigation strategies, and permit requirements.

SELECTION DECISION

After considering the evaluation criteria, the program policy factors, and the separate NEPA documents as identified in the PON, the SSO selected 9 projects as best furthering the objectives of the CCT-IV PON. These projects are listed in Exhibit 3. Brief summaries follow for each selected project. Abstracts of all proposals received are contained in Appendix B.

1. Cordero Mining Company

The proposed project will demonstrate the Carbontech Syncoal Process to upgrade high moisture, low-sulfur, low-rank coals. This upgraded fuel could be used in power plants designed to burn higher Btu coals, and as a low sulfur fuel for future power generation and industrial facilities. The project will be located at the Cordero Mine in Gillette, Campbell County, Wyoming.

The new technology consists of a two-stage drying process. The first stage drier uses a mixture of hot fuel oils to drive part of the moisture from the coal. The resulting oil coating also provides a barrier to prevent moisture reabsorption and spontaneous combustion. The second drying step uses hot flue gas to further dry the oil coated coal. The advantage of this process is that it upgrades low rank, low sulfur Western coals, to produce a higher Btu/pound fuel that should be moisture-repellent, resistant to attrition and dusting, and resistant to spontaneous combustion.

2. Custom Coals International, a joint venture between Duquesne Ventures, a subsidiary of Duquesne Light Co., and Genesis Research Corporation

The proposed project will demonstrate the "Self-Scrubbing Coal" technology which involves the integration of advanced physical coal cleaning with coal/sorbent reconstitution techniques to produce a utility or large industry fuel which emits less than 1.2 lb SO_2/MMBtu. Two forms of cleaned coal will be produced. These include Carefree Coal (i.e., coal that has been aggressively cleaned) and self-scrubbing coal (i.e., Carefree Coal with a limestone based additive).

The technology envelope includes the use of: 1) Genesis Desliming and Genesis Dense Media Cyclones; 2) Micron-Sized magnetite production from waste steel mill pickle liquor; 3) Countercurrent and multistage magnetite recovery circuits; 4) Sorbent addition during pelletization of 105 x 15 micron deep-cleaned coal. The proposers will also demonstrate enhanced sulfur capture with the Self-Scrubbing Coals in low NO_x burners. The proposers target the near-term utility retrofit market.

The demonstration plant will produce Self-Scrubbing and Carefree Coal from 250 tons of coal feed per hour at Duquesne Light Co.'s commercial coal cleaning facility located in Greensboro, Greene County, Pennsylvania. Tests of the product are to be conducted at Duquesne Light Co.'s 570 MWe Cheswick Plant located in Springdale, Allegheny County, Pennsylvania, and Richmond Power and Light Co.'s 60 MWe Whitewater Valley Station located in Richmond, Wayne County, Indiana.

3. New York State Electric & Gas Corporation

The proposed project will demonstrate a combination of cost-effective, emission reduction, and efficiency improvement technologies that will allow utilities to comply with the Clean Air Act Amendments of 1990. Reduction of sulfur dioxide and nitrogen oxides will be achieved at a reduced cost with minimal impact on station efficiency or heat rate. The project will be demonstrated on Milliken Station Units 1 and 2 (300 MW) located in Lansing, Tompkins County, New York.

The Saarberg-Hotler-Umwelttechik GMBH (S-H-U) flue gas desulfurization process is a formic acid-enhanced wet limestone scrubber technology that will demonstrate 98% SO_2 removal with low energy consumption, production of commercial grade gypsum, with high system reliability. In the S-H-U process, flue gas is subjected to both concurrent and countercurrent limestone slurry sprays. Flue gas desulfurization takes place in a Stebbins Engineering and Manufacturing Co.'s tile-lined split module absorber. The tile lining will provide lower life cycle costs and reduced maintenance problems due to the superior corrosion and abrasion resistance of the tile. The split module design will provide greater operational flexibility for the two demonstration generating units than a single absorber module, and will have lower capital and space requirements than two stand-alone modules. The Noxout injection system provided by NALCO Fuel Tech is a low capital cost energy efficient method of decreasing NO_x emissions by urea injection in the boiler flue gas. The heat- pipe air heater system will be installed to combine the benefits of a heat-pipe air heater with advanced temperature controls to reduce air in-leakage and to allow reduction in the air heater flue gas exit temperatures.

4. Sierra Pacific Power Company

The proposed project includes the design, construction, and operation of a new 80 MWe integrated gasification combined-cycle (IGCC) plant which will incorporate an air-blown KRW fluidized-bed gasifier producing a low-Btu gas which is used as fuel in a combined cycle power plant. The project will be demonstrated at Sierra Pacific Power Company's Tracy Station near Reno, Storey County, Nevada. The gasification system also includes hot gas removal of particulate and sulfur compounds from the fuel gas to produce a plant with exceptionally low atmospheric emissions. Desulfurization is accomplished by a combination of limestone injection into the fluidized-bed gasifier and by external zinc ferrite fixed-bed desulfurization reactors. Particulate removal is accomplished by high efficiency cyclones and a barrier filter. The demonstration project will have an estimated heat rate of 9500 Btu/Kwh.

5. TAMCO Power Partners, a general partnership between Tampella Power Corporation and Coastal Power Production Company

The proposed project will demonstrate an IGCC process consisting of an air-blown, fluidized-bed gasifier (Tampella U-Gas), gas cooler/steam generator, and hot gas cleanup in combination with a GE

MS 6001 gas turbine modified for use with either a low-Btu gas or natural gas and a conventional steam bottoming cycle. The demonstration will be located at a site near Coeburn, Wise County, Virginia. The plant will use 430 tons per day of locally mined bituminous coal to produce 55 MWe of power from a coal-gas fired gas turbine. A total 107 MWe of power will be delivered to the electric grid at the completion of the project. The power will be produced from two gas turbines (net power 67 MWe), one coal-gas fired and one natural gas fired, and an additional 40 MWe net from the steam turbine. In addition, 20,000 pounds per hour of steam will be exported to in a nearby coal preparation plant. Sulfur removal is accomplished in two steps. Dolomite is used for in-bed gasifier sulfur capture and down-stream cleanup is accomplished in a fluidized-bed of regenerative zinc titanite. Particulate cleanup, before the gas turbine, will be performed by high temperature candle filters (1,000^{0}F). The demonstration plant heat rate is estimated to be 8700 Btu/kWh.

6. Tennessee Valley Authority

The proposed project will demonstrate the reduction of NO_x emissions by the retrofit of coal reburning to a pulverized coal, wall-fired boiler on an existing 175 MWe wall-fired unit at the Shawnee Fossil Plant near Paducah, McCracken County, Kentucky.

The coal at the new demonstration site (a low sulfur, bituminous coal from eastern Kentucky or West Virginia) will be employed as the reburn fuel; however, it will be micronized (80% below 325 mesh). Up to 30% of the total fuel fired in the furnace will be micronized size. An incidental benefit, at TVA's Shawnee site, will be the restoration of the total mill capacity to the original 175 MWe. Currently, a mill capacity limitation exists due to the use of a coal differing substantially from the design coal.

7. ThermoChem, Inc.

The proposed project is to demonstrate Manufacturing and Technology Conversion International, Inc.'s (MTCI) pulse combustor in an application for steam gasification of coal. This gasification process will produce a medium Btu-content fuel gas from subbituminous coal at Weyerhaeuser Paper Company's Container Board Division mill in Springfield, Lane County, Oregon. The fuel gas and by-product steam produced by this demonstration unit will be used in the mill to offset use of existing hog-fuel boilers. The eventual replacement of all five existing hog-fuel boilers is contemplated.

This demonstration will be of an industrial size gasifier. The heat required for the gasification will be supplied by the combustion of cleaned gasification products (fuel gas) in numerous pulsed combustion tubes. The products of pulsed combustion are separated from the gasification products. Since no dilution of the by-products of combustion or of gasified fuel gas occurs, a medium Btu-content fuel (500 Btu/scf) gas will be produced. The turbulent nature of the pulsed combustor contributes to a high heat release and high heat transfer rates to the gasifier bed. The fluidized-bed coal gasifier also offers high turbulence and heat transfer rates. The high heat transfer rates on both sides of the pulsed combustion tubes will reduce the amount of heat transfer area required and result in a compact design.

8. Union Carbide Chemicals and Plastics Company, Inc.

In this project a 75 MWe CANSOLV regenerable flue gas desulfurization system will be designed, constructed, and operated at the ALCOA Generating Corporation Warrick Power Plant near Newburgh, Warrick County, Indiana. The process is designed to operate as an in-duct scrubber system. The retrofit scrubber facility will be installed in one of two flue gas ducts for an existing 150 MWe boiler.

The CANSOLV process is a regenerable system that removes SO_2 from the flue gas stream by contact with an aqueous amine absorbent. The absorbent is regenerated thermally in a separate unit and a slipstream is treated to prevent the build-up of impurities. The SO_2 is recovered as liquid SO_2 for conversion to marketable products. No additional solid or liquid wastes are generated with this process and less space is required than for conventional limestone scrubbing.

9. Wabash River Coal Gasification Project Joint Venture, a joint venture between Destec Energy, Inc. and PSI Energy, Inc.

The proposed project will demonstrate a nominal 265 MWe (net) IGCC power plant. The project will repower one of six units at PSI Energy's Wabash River Generating Station in West Terre Haute, Vigo County, Indiana.

The IGCC system is based on an oxygen-blown, two-stage entrained coal gasifier, developed by the Dow Chemical Company, using about 2500 tons per day of high sulfur eastern bituminous coal. The demonstration plant will use a high pressure boiler (syngas cooler) to drop gas temperatures from the gasifier outlet (1900^0F) to the 450^0F needed for warm particulate removal and low temperature acid gas removal. Consistent with IGCC technology, this demonstration plant will have very low environmental emissions (greater than 98% sulfur removal and greater than 90% NO_x removal) and will produce a slag that is inert. The slag will be sold as a by-product along with the sulfur produced. The resultant medium-Btu syngas will be burned in a Turbo Power and Marine combustion gas turbine rated at about 198 MWe. A heat recovery steam generator and steam power generating turbine will produce an additional 104 MWe of electricity. The demonstration plant heat rate will be 8740 Btu/kWh.

Exhibit 3

CLEAN COAL TECHNOLOGY IV PROJECTS
SELECTED BY THE DEPARTMENT OF ENERGY

Proposer	Technical Approach	Project Location
Cordero Mining Company	New Fuel Form; advanced coal preparation; two stage drying including hot oil for coal upgrading	Gillette, Campbell County, Wyoming
Custom Coals International, a joint venture between Duquesne Ventures, a subsidiary of Duquesne Light Co., and Genesis Research Corporation	Coal Preparation; advanced coal cleaning; coal sorbent reconstitution to produce clean solid fuel	Greensboro, Greene County, Pennsylvania; Springdale, Allegheny County, Pennsylvania; Richmond, Wayne County, Indiana
New York State Electric & Gas Corporation	Flue Gas Cleanup; advanced wet limestone, formic acid scrubber for SO_2 control; NO_xOUT process for NO_x control	Lansing, Tompkins County, New York
Sierra Pacific Power Company	Integrated Gasification Combined-Cycle; KRW air blown, fluid-bed gasifier, fixed-bed hot gas cleanup	near Reno, Storey County, Nevada
TAMCO Power Partners, a general partnership between Tampella Power Company and Coastal Power Production Company	Integrated Gasification Combined-Cycle; Tampella U-Gas air blown, fluid-bed gasifier, fluid-bed hot gas cleanup	near Coeburn, Wise County, Virginia

Exhibit 3 (Continued)

CLEAN COAL TECHNOLOGY IV PROJECTS
SELECTED BY THE DEPARTMENT OF ENERGY

Proposer	Technical Approach	Project Location
Tennessee Valley Authority	Advanced Combustion; coal reburning using micronized coal for NO_x control	near Paducah, McCracken County, Kentucky
ThermoChem, Inc.	Advanced Combustion; use of pulse combustion for indirect heating of the coal gasifier	Springfield, Lane County, Oregon
Union Carbide Chemicals and Plastics Company, Inc.	Flue Gas Cleanup; regenerable amine wet scrubbing process for SO_2 control, liquid SO_2 salable byproduct	near Newburgh, Warrick County, Indiana
Wabash River Coal Gasification Repowering Project Joint Venture, a joint venture between Destec Energy, Inc. and PSI Energy, Inc.	Integrated Gasification Combined-Cycle; DOW oxygen blown, entrained flow gasification, cold gas cleanup	West Terre Haute, Vigo County, Indiana

III. DESCRIPTIONS OF CCT-IV PROPOSALS RECEIVED

Thirty three proposals were received in response to the CCT-IV PON. The proposals exhibited substantial diversity in terms of technologies, project size and duration, geographic distribution, type of coal used, as well as environmental and commercialization characteristics. The following discussion provides an overview of the technologies and the geographic distribution of the proposals received. This discussion provides only limited information on the characteristics of the proposal. The reader is referred to Appendix B for summary descriptions of each proposed project.

TECHNOLOGIES PROPOSED

The projects proposed generally can be assigned to one of seven major advanced technology categories. These include: Advanced Combustion (AC), Coal Preparation (CP), Flue Gas Cleanup (FGC), Fluidized-Bed Combustion (FBC), Industrial (IND), Integrated Gasification Combined-Cycle (IGCC), and New Fuel Forms (NFF). These categories and the number of proposals received in each category are shown in Exhibit 4.

Exhibit 4

Distribution of Proposals by Technology Category

Technology Category	Code	Number of Proposals
Advanced Combustion	AC	5
Coal Preparation	CP	3
Flue Gas Cleanup	FGC	9
Fluidized-bed Combustion	FBC	3
Industrial	IND	1
Integrated Gasification Combined-Cycle	IGCC	6
New Fuel Form	NFF	6

Exhibit 5 identifies the proposer and technical approach associated with each proposal.

Exhibit 5

PROPOSED TECHNICAL APPROACHES BY TECHNOLOGY CATEGORY

Technology	Proposer	Technical Approach
Advanced Combustion	ABB Energy Ventures, Inc.	Physical coal cleaning with pulverized coal and fluid-bed boilers
	Energy and Environmental Research Corporation	Advanced gas reburning and selective non-catalytic reduction for NO_x control
	Pedco Incorporated	Rotary kiln combustor
	Tennessee Valley Authority	Coal reburning using micronized coal for NO_x control
	ThermoChem, Inc.	Pulse combustion for indirect heating of coal gasifier
Coal Preparation	Custom Coals International, a joint venture between Duquesne Ventures, a subsidiary of Duquesne Light Co., and Genesis Research Corporation	Advanced coal cleaning and sorbent reconstitution to produce clean solid fuel
	Energy and Environmental Research Corporation	Advanced cleaning of coal fines and production of a coal slurry for utility applications
	Energy Resources & Logistics	Coal slurry fired in diesel engine

Exhibit 5 (Continued)

PROPOSED TECHNICAL APPROACHES BY TECHNOLOGY CATEGORY

Technology	Proposer	Technical Approach
Flue Gas Cleanup	ABB Flakt, Inc.	Calcium silicate sorbent injection with recycle
	AQUATECH Systems, Allied-Signal, Inc.	Regenerable sodium based desulfurization and urea/methanol combustion for SO_2/ NO_x control
	The Babcock & Wilcox Company	Wet scrubber desulfurization and cyclone reburning for NO_x/SO_2 control
	Bechtel Corporation	Wet scrubber desulfurization
	Lin Technologies, Inc.	Sorbent Injection and test of solid waste for wide scale utilization
	New York State Electric & Gas Corporation	Advanced wet limestone, formic acid scrubber for SO_2 control NO_xOUT process for NO_x control
	Pure Air, On the Lake, L.P.	Wet scrubber desulfurization with a co-current super scrubber
	The Ralph M. Parsons Company	Catalytic reduction of SO_2 and NO_x with recovery of sulfur

Exhibit 5 (Continued)

PROPOSED TECHNICAL APPROACHES BY TECHNOLOGY CATEGORY

Technology	Proposer	Technical Approach
Flue Gas Cleanup (Continued)	Union Carbide Chemicals and Plastics Company, Inc.	Regenerable amine wet scrubbing process for SO_2 control, with liquid SO_2 as a salable byproduct
Fluidized-bed Combustion	Air Products and Chemicals, Inc.	Pressurized circulating fluidized-bed
	Iowa Power, Inc.	Pressurized circulating fluidized-bed
	Manitowoc Public Utilities	Coal carbonization to produce fuel gas and char along with a pressurized circulating fluid-bed combustor for char
Integrated Gasification Combined-Cycle	Calderon Energy Company	Pressurized pyrolysis (i.e., mild gasification) for production of methanol with air blown, entrained flow char gasification for power
	Freetown Energy Park	Texaco oxygen blown, entrained flow gasification, cold gas cleanup

Exhibit 5 (Continued)

PROPOSED TECHNICAL APPROACHES BY TECHNOLOGY CATEGORY

Technology	Proposer	Technical Approach
Integrated Gasification Combined-Cycle (Continued)	Sierra Pacific Power Company	KRW air blown, fluid-bed gasifier, fixed bed hot gas cleanup
	TAMCO Power Partners, a general partnership between Tampella Power Corporation and Coastal Power Production Company	Tampella U-Gas air blown, fluid-bed gasifier, fluid-bed hot gas cleanup
	Tennessee Valley Authority	Oxygen blown, entrained flow gasification, cold gas cleanup, to produce power and fertilizer
	Wabash River Coal Gasification Repowering Project Joint Venture, a joint venture between Destec Energy, Inc. and PSI Energy, Inc.)	DOW oxygen blown, entrained flow gasification, cold gas cleanup
Industrial	Geneva Steel	Direct iron reduction to eliminate coke production
New Fuel Forms	Char-Fuels Associates Limited Partnership	High pressure hydrodisproportionation process for production of liquids and char
	CLC Associates, Inc.	Pyrolysis for production of coal liquids and coke

Exhibit 5 (Continued)

PROPOSED TECHNICAL APPROACHES BY TECHNOLOGY CATEGORY

Technology	Proposer	Technical Approach
New Fuel Forms (Continued)	Cordero Mining Company	Two stage drying including hot oil for coal upgrading
	Frontier Energy Corporation	Coal/oil coprocessing for liquid hydrocarbons
	Heartland Fuels Corporation	Pressurized steam treatment for coal upgrading
	Leas Industrial Associates	Two step mild gasification process

GEOGRAPHIC DISTRIBUTION

The proposed projects in the 33 proposals covered each of the major coal producing regions. Exhibit 6 lists the geographic location of the project site for each proposal submitted.

Exhibit 6

GEOGRAPHIC LOCATIONS OF PROJECT SITES

State	Proposer	Project Site
Georgia	Bechtel Corporation	Roopville, Carroll County
Iowa	Iowa Power, Inc.	Pleasant Hill, Polk County
Illinois	The Babcock & Wilcox Company	Baldwin, Randolph County
	Energy and Environmental Research Corporation	Springfield, Sangamon County*

* Project has proposed multiple sites

Exhibit 6 (Continued)

GEOGRAPHIC LOCATIONS OF PROJECT SITES

State	Proposer	Project Site
Indiana	Custom Coals International, a joint venture between Duquesne Ventures, a subsidiary of Duquesne Light Co., and Genesis Research Corporation	Richmond, Wayne County*
	Leas Industrial Associates	Mount Vernon, Posey County
	Lin Technologies, Inc.	Richmond, Wayne County*
	Union Carbide Chemicals and Plastics Company, Inc.	near Newburgh, Warrick County
	Wabash River Coal Gasification Repowering Project Joint Venture, a joint venture between Destec Energy, Inc. and PSI Energy, Inc.	West Terre Haute, Vigo County
Kentucky	Tennessee Valley Authority	near Paducah, McCracken County

* Project has proposed multiple sites

Exhibit 6 (Continued)

GEOGRAPHIC LOCATIONS OF PROJECT SITES

State	Proposer	Project Site
Massachusetts	Freetown Energy Park	Freetown, Bristol County
Nevada	Sierra Pacific Power Company	near Reno, Storey County
New York	AQUATECH Systems, Allied Signal Inc.	Dunkirk, Chautauqua County
	New York State Electric & Gas Corporation	Lansing, Tompkins County
Ohio	Calderon Energy Company	Bowling Green, Wood County
	Frontier Energy Corporation	Painseville Township, Lake County
	Lin Technologies, Inc.	Columbus, Franklin County*
	The Ralph M. Parsons Company	St. Marys, Auglaize County

* Project has proposed multiple sites

Exhibit 6 (Continued)

GEOGRAPHIC LOCATIONS OF PROJECT SITES

State	Proposer	Project Site
Oregon	ThermoChem, Inc.	Springfield, Lane County
Pennsylvania	Air Products and Chemicals, Inc.	Erie, Erie County
	Custom Coals International, a joint venture between Duquesne Ventures, a subsidiary of Duquesne Light Co., and Genesis Research Corporation	Greensboro, Greene County; Springdale, Allegheny County*
	Energy and Environmental Research Corporation	Homer City, Indiana County
	Pure Air, On the Lake, L.P.	near Johnstown, Indiana County
Tennessee	ABB Flakt, Inc.	Kingston, Roane County
	Energy and Environmental Research Corporation	Memphis, Shelby County*
	Pedco Incorporated	Elizabethton, Carter County
	Tennessee Valley Authority	Saltillo, Hardin County

* Project has proposed multiple sites

Exhibit 6 (Continued)

GEOGRAPHIC LOCATIONS OF PROJECT SITES

State	Proposer	Project Site
Utah	Geneva Steel	Vineyard Town, Utah County
Virginia	CLC Associates, Inc.	Esserville, Wise County
	TAMCO Power Partners, a general partnership between Tampella Power Corporation and Coastal Power Production Company	near Coeburn, Wise County
Wisconsin	Manitowoc Public Utilities	Manitowoc, Manitowoc County
West Virginia	ABB Energy Ventures, Inc.	Eccles, Raleigh County
	Energy Resources & Logistics	White Sulfur Springs, Greenbrier County
Wyoming	Char-Fuels Associates Limited Partnership	Glenrock, Converse County
	Cordero Mining Company	Gillette, Campbell County
	Heartland Fuels Corporation	Gillette, Campbell County

IV. ENVIRONMENTAL CONSIDERATIONS

The Clean Coal Technology Demonstration Program has a strong environmental orientation. A number of approaches have been implemented to keep environmental considerations an integral part of clean coal demonstrations. These approaches involve two kinds of environmental activities. One involves the National Environmental Policy Act (NEPA) to satisfy the statutory requirements of DOE, and the other involves monitoring environmental and health impacts and performance over the life time of the project. These two types of activities are explained below.

NEPA STRATEGY

The overall strategy implemented to achieve compliance with NEPA includes both programmatic and project specific environmental impact considerations, during and subsequent to the selection process. These have and will ensure that environmental factors are fully evaluated and integrated into the decision-making process in order to satisfy DOE's NEPA responsibilities.

Proposers were required to submit both programmatic and project-specific environmental data as a discrete part of the proposal. DOE independently evaluated the environmental data and analyses submitted to develop supplemental information, and perform analyses as necessary to support reasoned decision-making. Major elements of the NEPA strategy are summarized below.

Programmatic Environmental Impact Statement

DOE has prepared a Programmatic Environmental Impact Statement (PEIS) on the Clean Coal Technology Demonstration Program. The final PEIS was published on November 3, 1989, drawing upon a draft PEIS published in June 1989, and the Programmatic Environmental Impact Analysis completed for the CCT-II solicitation and published in September 1988.[4] Comments on the scope of the PEIS were sought in a *Federal Register* notice dated February 7, 1989. The PEIS evaluates two alternatives: "no action," which assumes the CCT Program is not continued and conventional coal-fired technologies with conventional flue gas desulfurization controls continue to be used; and a "proposed action," alternative which assumes that CCT Program projects are selected for funding and successfully demonstrated with technologies entering widespread commercialization by the year 2010. The analyses of environmental consequences focuses on changes to four emissions of concern: SO_2, NO_x, CO_2, and solid wastes. An upper bound of change to each of these four parameters was estimated for each of 22 generic CCT's separately, assuming full penetration of potential markets.

DOE received comments on the draft PEIS and subsequently provided them in an appendix to the final document. The text of the final PEIS was modified where appropriate. After the required 30-day waiting period following issuance of the final PEIS, a Record of Decision to proceed with the CCT Program was published in the *Federal Register* on December 14, 1989 (54 F.R. 51313).

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[4]*Clean Coal Technology Demonstration Program Final Programmatic Environmental Impact Statement*, Report No. DOE/EIS-0146, U.S. Department of Energy, November, 1989; *Clean Coal Technology Demonstration Program Draft Programmatic Environmental Impact Statement*, Report No. DOE/EIS-0146D, U.S. Department of Energy, June, 1989; *Clean Coal Technology Programmatic Environmental Impact Analysis, Report No. DOE/PEIS-0002*, U.S. Department of Energy, September, 1988.

Project-Specific Environmental Review

For proposals that underwent comprehensive evaluation, DOE prepared and considered, before the selection of projects, an environmental impact review that focused on environmental issues pertinent to decision-making. The reviews summarized the strengths and weaknesses of each proposal against the environmental evaluation criteria, including (1) adequacy and appropriateness of proposed approaches for meeting and exceeding all environmental, health, safety, and socioeconomic (EHSS) requirements and minimizing EHSS impacts of the proposed demonstration project, (2) extent to which current emissions of sulfur dioxide and/or oxides of nitrogen are reduced in accordance with the provisions of the Clean Air Act, and (3) suitability, quality, and adequacy of the site(s) and/or facility(ies) for the proposed demonstration project. Additional consideration was given to reduction of emissions of greenhouse gases and air toxics, and the extent to which the site enhanced EHSS aspects. Due to the confidential content of this document, it is not available to the public.

Post-Selection NEPA Review

Upon award of federal financial assistance, proposers are required to submit additional environmental information.[5] This detailed site and project-specific information is to be used, along with independent information gathered by DOE, as the basis for site-specific NEPA documents to be prepared by DOE for each selected project. Such NEPA documents are to be prepared, considered, and published in full conformance with the Council on Environmental Quality's (CEQ) NEPA regulations and in advance of a decision by DOE to share costs beyond preliminary design.[6]

Federal funds from the Clean Coal Technology Demonstration Program can not to be provided for detailed design, construction, operation, and/or dismantlement until the NEPA process has been completed successfully.

Selected proposers did prepare the necessary information and did submit it to DOE as part of a self-contained *Volume of Environmental Information* that includes:

- A summary of environmental, health, safety, and socioeconomic information and analysis
- A description of the environmental setting of the proposed project, including a physical description of the project site and environmental conditions

[5]The required information was specified in Appendix J, "Information Requirements for the National Environmental Policy Act," of the CCT-IV PON.

[6]CEQ's NEPA regulations are in 40 CFR Parts 1500-1508; DOE guidelines were published in 45 *Federal Register* 20 (694), 1980.

- A description of the project's facility requirements (e.g., resources and off-site facilities), overall plant site and setting, and plant/process residuals (e.g., discharges and waste storage)

- A discussion of the impacts and consequences of the project at the selected site, plans for offsetting such impacts, and a summary and ranking of the consequences according to risk for project implementation

- An identification and preliminary assessment of the major environmental laws and regulations (federal, state, and local) for which compliance will be necessary prior to implementation of the project

- Information for assessing the project's impacts, if any, on water resource requirements and water availability

ENVIRONMENTAL MONITORING REVIEW

DOE views the identification and characterization of areas of concern, and the development of an information base for the assessment and mitigation of impacts associated with the replication of clean coal technology projects, to be a fundamental purpose of environmental and health monitoring and an important component of the demonstration project. Monitoring should identify the environmental constraints and/or advantages of potential commercial versions of the demonstrated technology. In addition, environmental monitoring may be necessary to detect any environmental and health problems requiring remedial actions, and to confirm the performance of environmental mitigation measures implemented as part of the project. Towards these ends, DOE requires that the participant (i.e., *selected proposer) perform a broad range of monitoring activities related to potential* environmental and health impacts of the project and technology.

Monitoring activities are documented in the form of an Environmental Monitoring Plan (EMP).[7] The EMP is developed, in consultation with and subsequently approved by DOE. It is subject to revision and updating as the project progresses. The EMP is described below.

Environmental Monitoring Plan

The EMP reflects additional monitoring requirements over and above any that may be identified in the NEPA process. The plan specifies the details regarding sampling locations, monitoring parameters, and sampling and analytical procedures. Development of the EMP is expected to take place along with the design of the project.

[7]Guidelines for development of the EMP were provided in Appendix N, "Environmental Monitoring Plan Guidelines," of the CCT-IV PON.

The EMP contains the following information:

- **EMP Purpose and Scope**--Definition of the overall approach to the monitoring and measurement activities

- **Project/Process Description**--Technology description, process flow diagrams, process and discharge streams, and pollution control systems

- **Environmental Characterization**--Plans for developing an information base for identification, assessment, and mitigation of environmental problems associated with the replication of the technology, including definition of the parameters that establish process operating conditions and determine environmental discharge characteristics

- **Compliance Monitoring**--Identification of permits, conditions of permits, and monitoring requirements of permits in terms of type of monitoring and timing

- **Supplemental Environmental Impact Monitoring**--Specific monitoring plans to identify and confirm selected environmental impacts and predicted performance

- **Integration of Monitoring Activities**--A break down of specific monitoring activities by project phases and monitoring media to avoid redundancy in the monitoring

- **Data Management and Reporting**--Description of the data management system to be used, reporting schedule, report contents and format, and types of analyses.

APPENDIX A

TECHNOLOGY DESCRIPTIONS

TECHNOLOGY DESCRIPTIONS

SUMMARY

The term clean coal technology refers to a new generation of advanced coal utilization technologies that are environmentally cleaner and in many cases more efficient and less costly than conventional coal-using processes. These new energy and pollution control systems are the products of years of research and development in hundreds of government and private laboratories throughout the world. Commercial demonstration of these technologies is the final step in moving them from the research laboratory to the marketplace. Clean coal technologies offer the potential for a cleaner environment and lower power costs by contributing to the resolution of issues relating to acid rain, global climate change, future energy needs, and energy security.

Clean coal technologies can reduce emissions of SO_2, NO_x, and other pollutants at three major points along the path that coal generally follows from a mine to its use in a power plant or factory:

1. **Precombustion Stage.** Physically, chemically, or biologically cleaning the coal, i.e., removing pollutants before the coal is combusted.

2. **Combustion Stage.** Modifying the combustion process, such as staging the combustion or fluidizing and/or pressurizing the coal and ash in the combustion zone, or injecting other fuels and/or additives into the combustion zone for the purpose of capturing or breaking down pollutants.

3. **Postcombustion Stage.** Removing pollutants from the flue gases after they exit the boiler, i.e., employing cleanup devices beyond both the combustion and heat transfer sections of the power generating system.

Coal conversion represents a fourth means of using coal cleanly; it is a departure from traditional coal-burning methods in that the coal is converted into a gas or liquid that can be cleaned and then used as fuel.

PRECOMBUSTION CLEANING

About 40 percent of the coal used in U.S. utility boilers today receives some cleaning before it is burned. Most commercial coal cleaning is done on eastern and midwestern bituminous coals at more than 500 preparation plants. With wider use of conventional coal-cleaning processes, total nationwide SO_2 emissions from burning coal could be reduced by at least 10 percent. To achieve greater reductions, however, significant improvements will have to be made to coal-cleaning technology. Traditionally, research to improve precombustion cleaning has been concentrated on two major categories of cleaning technology: physical cleaning and chemical cleaning. Recently a new category, biological cleaning, has attracted interest as advances have been made in microbial and enzymatic techniques for liberating sulfur and ash from coal.

Physical Cleaning

Virtually all coal cleaning today is done with physical techniques, some of which have been used for more than a century. Physical cleaning typically separates undesirable matter from coal by relying on differences in densities or variations in surface properties between the ash/residue material and the coal. When coal from the mine is crushed and then washed, the heavier impurities are separated.

Physical cleaning can remove only matter that is physically distinct from the coal, such as small dirt particles, rocks, and pyritic sulfur (sulfur combined with iron particles). Physical cleaning cannot remove sulfur that is chemically combined with the coal (organic sulfur), nor can it remove nitrogen, another source of pollution, from the coal. Currently, physical cleaning can remove 30-50 percent of the pyritic sulfur (or 10-30 percent of the total sulfur) and about 60 percent of the ash-forming minerals in coal.

Advanced physical cleaning techniques are expected to be significantly more effective than older techniques. Increased effectiveness is achieved by first grinding the coal into much smaller sizes at which point the coal releases more of the ash and pyrite. Special separation technologies can be used to assure good coal recovery, and thermal treatment can be used to reduce moisture and modify surface characteristics to prevent moisture reabsorption. New coal-cleaning processes can remove more than 90 percent of the pyritic sulfur and undesirable minerals from the coal.

Chemical/Biological Cleaning

Removing organic sulfur that is chemically bound to the coal is a far greater challenge than removing pyritic sulfur through physical means. Currently, chemical and biological processes, which react with the coal, are being used to remove organic sulfur.

One chemical technique that has shown promise is molten caustic leaching. This technique exposes coal to a hot sodium- or potassium-based chemical. The chemical leaches sulfur and mineral matter from the coal. Other chemical techniques modify the chemical characteristics of coal in a way that makes the coal more receptive to cleaning.

Biological cleaning represents some of the most exotic techniques in coal cleaning. Researchers have identified naturally occurring bacteria that can eat the organic sulfur in coal. Other approaches involve using fungi, rather than bacteria, and injecting sulfur-digesting enzymes directly into the coal.

Chemical or biological coal cleaning appears to be capable of removing as much as 90 percent of the total sulfur (pyritic and organic) in coal. Some chemical techniques also can remove 99 percent of the ash.

CLEAN COMBUSTION

Clean combustion consists of removing the pollutants from coal as it is burned. This can be accomplished by controlling the combustion parameters (fuel, air/oxygen, and temperature) to minimize the formation of pollutants and/or by injecting pollutant-absorbing substances into the combustion chamber to capture the pollutants as they are formed.

In most conventional coal combustion plants, raw coal, pulverized into particles small enough to form a combustible cloud, is injected with hot air into burners along the lower portion of the furnace box or boiler. The coal burns in a long, luminous flame at temperatures of 2,700 °F or greater. The heat is transferred to water-filled tubes attached to the sides of the boiler. Boiling water in the tubes creates steam that spins a turbine generator, which produces electricity.

In conventional coal combustion plants, the principal design goal is high efficiency to extract the most energy from a unit of coal. With advanced combustion technologies, the goal is to reduce emissions while retaining high efficiencies by altering the combustion process.

Advanced Combustion

Advanced combustion systems control or remove SO_2, NO_x, and/or particulate matter from coal combustion gases before they enter a steam generator or heater. Pollutants are controlled by the combustion parameters and/or sorbents used during the combustion process. NO_x is normally controlled through staged combustion, natural gas reburning, coal reburning, or some method of controlling combustion flame temperature. SO_2 is controlled through sorbent injection in the combustion chamber. Ash can be controlled by operating at high temperatures and converting it into molten slag, although such high temperatures do not appear to be conducive to simultaneous NO_x and SO_2 capture.

Some advanced combustion systems are designed to reduce only NO_x emissions, while others are designed to reduce or capture several pollutants (NO_x, SO_2, and ash). Depending on the specific technology, these systems are capable of reducing NO_x emissions by 50-70 percent, SO_2 emissions by 50-95 percent, and ash by 50-90 percent when compared to conventional technology.

Examples of advanced combustion technologies include low-NO_x burners, slagging combustors, cyclone combustors, vortex combustors, pulsed combustors, limestone-injection multistage burners, as well as coal- and gas-reburning technologies.

Fluidized-Bed Combustion

Fluidized-bed combustion reduces emissions by controlling combustion parameters and by injecting a pollutant absorbent (such as crushed limestone), into the combustion chamber along with the coal. Pulverized coal mixed with crushed limestone is suspended on jets of air (or fluidized) in the combustion chamber. As the coal burns, sulfur is released, and the limestone captures the sulfur before it can escape from the boiler. The sulfur chemically combines with the limestone to form a solid waste product, a mixture of calcium sulfite and calcium sulfate. Some of the solid waste is removed with the bed ash through the bottom of the boiler. Small ash particles, or fly ash, that escape the boiler are captured with dust collectors (cyclones and baghouses). More than 90 percent of the sulfur released from coal can be captured in this manner.

The fluidized mixing of fuel and sorbent enhances both the coal-burning and sulfur-capturing processes and allows for reduced combustion temperatures of 1,400-1,600 °F, or almost half the temperature of a conventional boiler. This temperature range is below the threshold where most of the NO_x forms. Thus, fluidized-bed combustors substantially reduce both SO_2 and NO_x emissions.

Fluidized-bed combustors can be either atmospheric or pressurized. The atmospheric type operates at normal atmospheric pressure while the pressurized type operates at pressures 6-16 times higher than normal atmospheric pressure. The pressurized fluidized-bed boiler offers potentially higher efficiency, reduced operating costs, and less waste products than does the state-of-the-art atmospheric fluidized-bed boiler. A new type of atmospheric fluidized-bed boiler offers circulating (entrained) fuel flow instead of the bubbling bed or dense used in earlier approaches. Circulating fluidized beds allow for finer coal feed, better fuel mixing, higher efficiencies, and increased SO_2 capture.

POSTCOMBUSTION CLEANING

Postcombustion cleaning involves removing SO_2, NO_x, and/or particulates from the downstream flue gas after it exits the boiler. Primary emphasis has been on SO_2 and NO_x removal. Conventional technology (wet scrubbers) uses lime or limestone to capture sulfur pollutants in the flue gas before it exits the stack. This technology tends to be plagued by corrosion and plugging. It also produces a wet waste product (sludge), which has high disposal costs. However, the reliability of wet scrubbers has improved significantly, and they have demonstrated the ability to remove more than 90 percent of the SO_2.

Advanced postcombustion cleaning technologies encompass two approaches: (1) using the existing flue gas ductwork to inject a sorbent and (2) inserting one or more separate vessels into the downstream ductwork where pollutant absorbents are added. Using a separate vessel allows a greater residence time for the absorbent to react, but the vessel is larger in size than the ductwork used with in-duct sorbent injection and is costlier to install.

Advanced postcombustion cleaning technologies offer several advantages over conventional technologies, such as the following:

1. Regeneration of the sulfur-absorbing chemical, making the system more economical

2. Increased residence time or reactivity with the sulfur absorbent

3. Reduced physical size requirements

4. A dry, environmentally benign waste product that may have commercial value

In-duct sorbent injection works inside the ductwork leading from the boiler to the smokestack. Sulfur absorbers (such as hydrated lime) are sprayed into the center of the duct. By controlling the humidity of the flue gas and the spray pattern of the sorbent, 50-70 percent of the SO_2 can be removed. Selective additives, such as adipic acid, may remove more than 90 percent of the SO_2. The reaction produces dry particles that can be collected downstream. Because the plant's existing ductwork is used, extensive new construction is not needed. This makes in-duct sorbent injection an attractive option for retrofitting smaller, older plants where space requirements might be limited.

When separate vessels are used, one or more process chambers are inserted in the flue gas ductwork, and various sorbents are injected to remove the pollutants. Generally the separate vessels provide a longer residence time for the absorbent to react with the gas, and pollutant capture is greater. Although more costly than in-duct injection, this approach has the potential of capturing more than

90 percent of the pollutants. Due to the cost and added size requirements, the use of separate vessels tends to be more suitable to new plant applications or to plants that can accommodate the additional size requirements. Technologies such as the spray dryer and selective catalytic reduction represent approaches that use separate vessels.

COAL CONVERSION

Techniques that convert coal into another form of fuel bypass the conventional coal "fuel path" altogether. In the most commonly envisioned systems, coal is converted into a gaseous fuel; in other techniques, a liquid product is made; while in still others, combinations of gases, liquids, and solids are produced.

Gasification Combined-Cycle Systems

The gasification combined-cycle process basically consists of the following four steps:

1. Fuel synthesis gases are formed by reacting coal with high-temperature steam and oxygen (or air) in the reactor vessel at either near atmospheric or elevated pressures.

2. The gases are cleaned.

3. The clean gases are burned, and the hot exhaust is routed through a gas turbine to generate electricity.

4. The residual heat in the exhaust is used to raise steam for a conventional steam turbine generator to produce additional electricity.

This combination of gas and steam turbines accounts for the name combined cycle. Gasification combined-cycle systems are among the cleanest and most efficient of the emerging clean coal technologies. Sulfur, nitrogen compounds, and particulates are removed before the fuel is burned in the gas turbine, that is, before combustion air is added. For this reason, there is a much lower volume of gas to be treated than in a postcombustion scrubber.

The gas stream must have extremely low levels of impurities not only to avoid pollution but to protect turbine components from erosion or corroding. In a coal gasifier, unlike coal combustion processes, the sulfur in coal is released in the form of hydrogen sulfide rather than sulfur dioxide. As in the case of clean combustion, much of the sulfur-containing gas can be captured by a sorbent injected into the gasifier. In addition, several commercial processes are capable of removing hydrogen sulfide. More than 99 percent of the sulfur can be removed from the gas, making it as clean as natural gas.

Some modern-day coal gasifiers release fuel gas at temperatures well in excess of 2,000 °F. This temperature range allows for increased efficiencies and a lower cost per unit of power. In some systems the hot coal gas is passed through a bed of zinc ferrite particles. Zinc ferrite can absorb sulfur contaminants at temperatures in excess of 1,000 °F, and the compound can be regenerated and reused with little loss of effectiveness. The technique is capable of removing more than 99.9 percent of the sulfur in coal.

High levels of nitrogen removal are also possible. Some of the coal's nitrogen is converted to ammonia, which can be almost totally removed by commercially available chemical processes. NO_x formed from the combustion air can be held to well within allowable levels by staging the combustion process at the turbine or by adding moisture to hold down flame temperature.

Mild Gasification

Mild gasification is a modification of conventional coal gasification that produces gaseous, solid, and liquid products by heating coal in an oxygen-free reactor. The process is a similar approach to pyrolysis which drives off the condensable volatile hydrocarbons and leaving behind carbon, under carefully controlled conditions selected to optimize the desired products.

Mild gasification processes generate multiple products by the medium-temperature treatment of coal. The products generated are characterized as coal-derived liquids, gases, and chars, depending on the operating conditions. The char can be beneficiated further to remove both ash and pyritic sulfur, mixed back with coal-derived liquids, and burned in both coal- and oil-fired boilers. By using a chemical beneficiation process, 90 percent of the sulfur and 90 percent of the nitrogen can be removed. Adding flue gas desulfurization systems could reduce emissions further. A slurry of coal-derived fuel and beneficiated char has the potential of being a very versatile fuel that can be burned in both coal- and oil-fired boilers. If the char is beneficiated to a high degree, even feedstock coal with a high sulfur content can be used without altering heat rates or capacity factors.

Coal Liquefaction

Two primary methods exist for converting coal into liquid fuels:

1. Indirect liquefaction - coal gasification followed by conversion of the synthesis gas to liquid fuels

2. Direct liquefaction - the conversion of the organic solid structures in coal directly into liquid fuels

Liquefaction of coal involves the addition of hydrogen to coal by various techniques so that the fuel's ratio of hydrogen to carbon is increased to a level comparable with petroleum-based fuels. Coprocessing, a recent development in liquefaction technology, involves the production of liquid fuel from a mixture of coal and heavy petroleum residue, with the residual oil providing all or most of the hydrogen needed for the conversion process. Once produced, the coal-derived liquid can be cleaned of its sulfur and ash before being used.

The major potential advantages of direct liquefaction include relatively high thermal efficiency (60-70 percent), high product yield, and the potential to make products such as high-quality motor gasoline. Principal disadvantages stem from the severe operating conditions required and the lack of integration among process steps. Moreover, direct liquefaction is more efficient and more selective to fuel-grade liquids than indirect liquefaction, while the indirect process is better suited to the production of diesel fuels.

Direct Coal Use in Iron Making

Coal injected directly into blast furnace tuyeres displaces fuel (e.g., natural gas) and coke, the primary blast furnace fuel and reductant. Coke is displaced on a pound-for-pound basis. Depending on the amount of coal fed, the coke requirement can be reduced by up to 40 percent, which results in net improvement to the environment. Sulfur in the coal is captured in the by-product slag. The slag can be reclaimed and used for a variety of products, including high-quality cement and roadbed aggregate.

MARKETS AND APPLICATIONS

Coal technologies can be categorized by market or technology application, as well as by process. Markets are normally thought of as the utility, industrial, commercial, residential, and transportation end-use sectors. New advanced clean coal technologies have primarily been geared toward the utility and industrial markets; however, many of these technologies are capable of providing energy and/or fuel applicable to all market sectors.

Technology applications are categorized as retrofit, repowering, or replacement, defined as follows:

- **Retrofit Applications** - Installing pollution control devices on older power plants without making major changes in the plant design. Retrofit technologies remove SO_2 and/or NO_x but generally do not increase the power output of the plant.

- **Repowering Applications** - Replacing a major portion of an existing plant (such as the boiler) with new steam raising and power-generating equipment while other portions of the plant (such as the steam-power generating equipment) are retained. Pollution control is inherent in the process; as added advantages, a repowered plant can produce more power--perhaps twice as much or more--than the original plant, and the plant's lifetime is extended by 20-30 years.

- **Replacement Applications** - Making a decision to discontinue the use of certain older facilities (e.g., boiler and power generation turbine) and instead to construct at the same site new, efficient generating facilities that use clean coal technologies. These technologies may be unsuitable for retrofitting or repowering existing units because of their large scale, design, or site-specific limitations.

Many of the advanced clean coal technologies can be used in more than one market or technology application. Categorization depends on the engineering design for a specific end user and application at a particular plant site.

APPENDIX B

PROPOSAL FACT SHEETS

INDEX OF PROJECTS PROPOSED
LISTED ALPHABETICALLY BY COMPANY NAME

PROPOSAL FACT SHEET

Proposer:	ABB Energy Ventures, Inc.
Proposal Title:	Eccles Project
Technology Category:	Advanced Combustion
Coal Type:	Bituminous (Westmoreland - Eagle; Kittanning)
Project Location:	Eccles, Raleigh County, West Virginia
Project Duration:	72 months
Estimated Project Cost:	$345,800,000
Estimated DOE Share:	$ 51,050,000 (14.8%)
Estimated Proposer Share:	$294,750,000 (85.2%)
Additional Team Members:	Westmoreland Energy, Inc. Energotechnology Corporation

Proposal Summary:

This project combines on-site coal cleaning with a pulverized coal-fired (PC) boiler and a smaller fluidized-bed combustion (FBC) boiler, to allow optimum utilization of both a cleaned coal and a waste coal stream. The system is applicable for retrofit, repowering and new plant applications. It is proposed by ABB Energy Ventures, Inc., with Westmoreland Energy, Inc. and Energotechnology Corporation as additional team members. This project will involve construction of a 200 MWe generating station on a greenfield site at Eccles, WV, adjacent to large coal deposits owned by Westmoreland Coal Company.

The coal cleaning technology is a conventional, physical process involving low cost and established technology. The cleaned coal is burned in a PC boiler which develops about 75% of the total thermal capacity of the plant. The remaining capacity is provided by a FBC boiler which accepts the waste (low-Btu) stream from the cleaning process. While limestone in a wet scrubber will achieve 93% removal of sulfur dioxide (SO_2) from the PC boiler, 95% removal of sulfur will be achieved by use of limestone in the FBC. Active controls are needed on the PC boiler to comply with New Source Performance Standards for SO_2 control. The system allows flexibility in coal selection.

The intention is to demonstrate low-cost abatement of SO_2 and NO_x emissions with a technology suitable for retrofit of existing power plants as well as for new construction.

PROPOSAL FACT SHEET

Proposer:	ABB-Flakt, Inc.
Proposal Title:	Demonstration of the ADVACATE-MDI Process at the Kingston Station
Technology Category:	Flue Gas Cleanup
Coal Type:	Bituminous (Kentucky, Virginia, Tennessee)
Project Location:	Kingston, Roane County, Tennessee
Project Duration:	36 months
Estimated Project Cost:	$49,888,490
Estimated DOE Share:	$24,944,245 (50%)
Estimated Proposer Share:	$24,944,245 (50%)
Additional Team Members:	Tennessee Valley Authority (TVA) Stone & Webster Engineering Corporation U.S. Environmental Protection Agency University of Texas Radian Corporation

Proposal Summary:

ABB-Flakt, Inc., in agreement with the TVA, proposes to design, build, and operate a duct injection flue gas desulfurization system at TVA's 200 MWe Unit 9 at the Kingston Steam Electric Generation Station near Knoxville, TN. The ADVACATE-MDI process will integrate the advanced calcium silicate injection technology, developed by EPA and the University of Texas, and the moist dust injection technology, developed by ABB-Flakt, Inc.

The ADVACATE sorbent is prepared by activating the silicate component in the fly ash through grinding and hydration reaction with lime at 150-190°F. The sorbent is injected into the flue gas duct upstream of the existing particulate collection device as a free-flowing powder that contains up to 40% H_2O. Because of the high moisture content of the specially prepared sorbent, there is no need for in-duct humidification of the flue gas. Thus, the process may be amenable to shorter sorbent residence times, and hence shorter duct lengths, than competing duct injection technologies. High calcium utilization is also achieved by recycling the sorbent. In the demonstration plant, spent sorbent and fly ash will be collected by an electrostatic precipitator (ESP) for disposal at a solid waste disposal site.

The goal of the ADVACATE-MDI demonstration is to achieve 90% reduction in SO_2 emissions at a Ca/S ratio of 1.1 to 1.3. Three coals with different ash characteristics and sulfur content will be tested. The performance of an ESP in removing the spent sorbent will be evaluated. The use of the spent sorbent in concrete manufacture will also be investigated.

PROPOSAL FACT SHEET

Proposer:	Air Products and Chemicals, Inc.
Proposal Title:	Demonstration of a Commercial Scale Advanced Pressurized Circulating Fluidized-bed Boiler Technology
Technology Category:	Fluidized-Bed Combustion
Coal Type:	Bituminous (Western Pennsylvania)
Project Location:	Erie, Erie County, Pennsylvania
Project Duration:	82 months
Estimated Project Cost:	$303,505,400
Estimated DOE Share:	$112,348,800 (37%)
Estimated Proposer Share:	$191,156,600 (63%)
Additional Team Members:	Deutsche Babcock Energie International Paper, Inc.

Proposal Summary:

Air Products and Chemicals, Inc. proposed to demonstrate Deutsche Babcock Energie's (DBE) first generation Pressurized Circulating Fluidized-Bed Combustion (PCFBC) technology. The demonstration will be in a cogeneration mode operation at International Paper Inc.'s Erie, Pennsylvania pulp and paper mill, and will generate 77.4 MWe power. The proposed demonstration will provide approximately one-half of the energy and steam requirements, and will also allow International Paper to decommission three of the 45 year old boilers and turbine generators. Duration of the proposed project would be 82 months.

Deutsche Babcock is offering a PCFBC system comprised of a circulating fluidized-bed boiler with integrated hot gas candle filters. The boiler/filter package is installed in a pressure vessel. The PCFBC is a coal-fired combined cycle power generation system. The arrangement of the filter integrated with a circulating bed is a novel concept.

Data obtained from the proposed demonstration will be used to scale-up to utility size systems on the order of 300 MWe.

PROPOSAL FACT SHEET

Proposer:	AQUATECH™ Systems, Allied-Signal, Inc.
Proposal Title:	Post Combustion Gas Cleanup-100 MWe SOXAL Demonstration Program, Regenerable Flue Gas Treating Process for Simultaneous SO_x/NO_x Control
Technology Category:	Flue Gas Cleanup
Coal Type:	Bituminous (Eastern)
Project Location:	Dunkirk, Chautauqua County, NY
Project Duration:	27 months
Estimated Project Cost:	$39,091,245
Estimated DOE Share:	$19,545,622 (50%)
Estimated Proposer Share:	$19,545,623 (50%)
Additional Team Members:	Niagara Mohawk Power Corporation Electric Power Research Institute New York State Energy Research and Development Authority Empire State Electric Energy Research Corporation

Proposal Summary:

AQUATECH™ Systems, Allied-Signal, Inc., Warren, New Jersey has proposed to demonstrate the technical and economic feasibility of the SOXAL™ process, an advanced flue gas treating process for simultaneous SO_x and NO_x control. Other members of the team will include Niagara Mohawk Power Corporation, New York State Energy Research and Development Authority, Empire State Electric Energy Research Corporation, and Electric Power Research Institute. The objectives of this control technique are to eliminate 90% of the SO_2 and 75-90% of the NO_x contaminants in the flue gas. This demonstration will take place at a nominal 100 MWe scale, at Niagara Mohawk's Dunkirk Steam Station No. 2 Unit located in Dunkirk, New York.

The SOXAL™ process is a regenerable, sodium-based flue gas treating process that produces a concentrated SO_2 product suitable for conversion to sulfuric acid (H_2SO_4), elemental sulfur or liquid SO_2. Simultaneous removal of SO_x and NO_x from the flue gas is achieved by staged injection of urea and methanol into selected boiler zones for NO_x control, followed by flue gas scrubbing for SO_x control. The advantages of the process are that it produces no residues and potentially has two commercially viable products, liquid SO_2 and sodium sulfate. Only the SO_2 product will be generated in this demonstration. The process is considered to be applicable to both utility and industrial boilers.

PROPOSAL FACT SHEET

Proposer:	The Babcock & Wilcox Company
Proposal Title:	Full-Scale Demonstration of Integrated Flue Gas Desulfurization System with Reburning NO_x Control
Technology Category:	Flue Gas Cleanup
Coal Type:	Bituminous (Illinois)
Project Location:	Baldwin, Randolph County, Illinois
Project Duration:	66 months
Estimated Project Cost:	$289,830,360
Estimated DOE Share:	$123,349,704 (42.6%)
Estimated Proposer Share:	$166,480,656 (57.4%)
Additional Team Members:	Illinois Power Company Burns & McDonnell Illinois Department of Energy & Natural Resources Radian Corporation Soyland Power Cooperative, Inc. Peabody Coal Company Arch Mineral Corporation Electric Power Research Institute

Proposal Summary:

The Babcock & Wilcox Company (B&W) proposes to retrofit Illinois Power Company's Baldwin Station Unit No. 1 (595 MWe) with its Integrated Flue Gas Desulfurization System (IFGDS) and coal-fired Cyclone Reburning Technology (CRT) to demonstrate cost-effective combined SO_2/NO_x control.

The IFGDS technology is an advanced wet scrubber that will remove SO_2 from the flue gas of a coal-fired utility boiler. It will utilize a single tower and limestone rich spray. Additives for improved SO_2 capture will be considered. The CRT technology uses coal reburning above the existing burners to reduce the NO_x emissions from the cyclone boiler.

The objectives of the demonstration are to accelerate near-term commercialization of these technologies with the goals of up to 98% SO_2 removal and 50% or more NO_x removal, as well as achieving cost savings when compared to conventional wet scrubber technology.

PROPOSAL FACT SHEET

Proposer:	Bechtel Corporation
Proposal Title:	1,800 MWe Flue Gas Desulfurization Retrofit, Demonstrating the Low-Cost 98% Removal of SO_2 Using Large-Scale Fiber-Glass-Reinforced Plastic Construction and U.S.-Developed Improvements to the Chiyoda CT-121 FGD Process
Technology Category:	Flue Gas Cleanup
Coal Type:	Bituminous (Illinois)
Project Location:	Roopville, Carroll County, Georgia
Project Duration:	67 months
Estimated Project Cost:	$224,000,000
Estimated DOE Share:	$ 67,200,000 (30%)
Estimated Proposer Share:	$156,800,000 (70%)
Additional Team Members:	Georgia Power Company Southern Company Services, Inc. Ershigs, Inc. Radian Corporation Ardaman & Associates, Inc.

Proposal Summary:

Bechtel Corporation is proposing to install the Chiyoda Thoroughbred - 121 (CT-121) flue gas desulfurization (FGD) process at the 2 x 900 MWe Plant Wansley Steam Generating Station in Georgia. Bechtel Corporation, U.S. licensee of the CT-121, will conduct the engineering, procurement, construction, and management as the prime contractor. Georgia Power Company, agent for the joint utility owners of the plant, will be responsible for the operation and maintenance during a 2-year evaluation program. Other team members are Southern Company Services, Inc., Ershigs, Inc., Radian Corporation, and Ardamon & Associates, Inc.

A unique feature of the CT-121 absorber is the Jet Bubbling Reactor (JBR) in which intimate contact is achieved between the flue gas and the limestone-based SO_2 absorbing medium by virtue of gas being sparged into a vessel of absorbent liquid. Other features of the process are relatively low pH, forced air oxidation in the liquid reaction zone to produce gypsum, and relatively low gas velocity in the disengaging section. The features combine to provide high SO_2 removal and low outlet particulate loadings with excellent reliability and availability.

The goal of the project is to achieve 98% SO_2 removal while burning up to 3.5% sulfur coal, with a performance guarantee of 95% removal. This is to be accomplished in the largest single FGD module in the world (900 MWe) to be constructed out of fiberglass-reinforced plastic.

PROPOSAL FACT SHEET

Proposer:	Calderon Energy Company
Proposal Title:	Liquid Fuel-IGCC Repowering
Technology Category:	Integrated Gasification Combined-Cycle
Coal Type:	Bituminous (Pittsburgh #8)
Project Location:	Bowling Green, Wood County, Ohio
Project Duration:	70.5 months
Estimated Project Cost:	$271,492,380
Estimated DOE Share:	$118,044,880 (43.5%)
Estimated Proposer Share:	$153,447,500 (56.5%)
Additional Team Members:	City of Bowling Green Wood County, Ohio Ohio Valley Coal Company

Proposal Summary:

Calderon Energy of Bowling Green, Ohio, has proposed a project which integrates the processing of coal for the co-production of syngas and its conversion to methanol (414 tons/day), and low-Btu content fuel gas (lean gas) and its conversion to electric power (80 MWe). The proposed project duration is 70.5 months.

This project uses the proprietary Calderon Process technology covered by two patents. The Calderon Process combines clean energy products from coal by means of pyrolysis, char gasification, and integrated regenerative hot gas cleanup. The pyrolysis unit is a heated, horizontal cylinder with a hydraulic ram that moves the coal through the cylinder. The coal is pyrolyzed and produces a "rich" pyrolysis gas and char. The char is gasified in a char gasifier producing a lean gas. The lean gas is desulfurized by a bed of hot lime and fed to the combined cycle gas turbine. The rich pyrolysis gas is cracked of hydrocarbons and desulfurized by the hot lime. The cleaned rich gas forms a synthesis gas for the production of methanol.

The oxides of sulfur (SO_x) are significantly reduced by virtue of the integrated hot gas cleanup. The oxides of nitrogen (NO_x) are kept to very low levels (under 0.02 pounds per million Btu of fuel feed) when the low-Btu gas is combusted in a boiler or gas turbine.

The proposed demonstration plant is designed to fully establish the integration of the proposed concept. The proposed plant should reduce emissions while producing elemental sulfur.

PROPOSAL FACT SHEET

Proposer:	Char-Fuels Associates Limited Partnership
Proposal Title:	CharFuel™ Coal Refining Project
Technology Category:	New Fuel Form
Coal Type:	Subbituminous (Powder River Basin)
Project Location:	Glenrock, Converse County, Wyoming
Project Duration:	36 months
Estimated Project Cost:	$24,644,310
Estimated DOE Share:	$12,322,155 (50%)
Estimated Proposer Share:	$12,322,155 (50%)
Additional Team Members:	The Babcock & Wilcox Company Stone & Webster Engineering Corporation Tennessee Valley Authority (TVA) Radian Corporation State of Wyoming Pacific Power & Light Company

Proposal Summary:

Char-Fuels Associates Limited Partnership, proposed to demonstrate the production of a slurry char/liquids fuel with lowered organic nitrogen and sulfur content. Other by-products such as methanol, MTBE, BTX and naphtha may be produced from effluents of this process.

The process takes pulverized coal and rapidly heats it in a reducing atmosphere. The reactions occur in a pyrolyzer (hydrodisproportionation unit (HDP)) heated by partially oxidized (POX) recycle gas. The POX step uses commercially produced oxygen to provide hot hydrogen containing reactant gases. The products of coal pyrolysis are quenched using hydrogen and coal liquids. The primary product streams are char, coal liquids, and gas that are further processed into Charfuel™ and other products. This process partially removes sulfur and nitrogen from the converted coal. The coal based fuel is easier to transport and handle than solid coal.

The objectives of this project are to design, build, and operate a pilot scale facility, optimizing its process parameters. Other objectives are to evaluate the combustion and rheological properties of Charfuel™ fluidic fuel. Economic information on the process will also be generated to aid in evaluation of the technology.

PROPOSAL FACT SHEET

Proposer:	CLC Associates, Inc.
Proposal Title:	*Demonstration of Coal Liquid and Coke (CLC) Mild* Gasification Process
Technology Category:	New Fuel Form
Coal Type:	Bituminous
Project Location:	Esserville, Wise County, Virginia
Project Duration:	63 months
Estimated Project Cost:	$124,500,000
Estimated DOE Share:	$ 62,250,000 (50%)
Estimated Proposer Share:	$ 62,250,000 (50%)
Additional Team Members:	Norfork Southern Corporation Coal Technology Corporation Rapoca Energy Company

Proposal Summary:

CLC Associates, Inc. proposed to demonstrate the application of new fuel forms technology to produce transportation fuels (coal liquids) and metallurgical coke for the steel industry.

This technology will be evaluated in a 1,500 tons per day coal feed demonstration plant to be located near Esserville, Virginia. The plant will be divided among three mild gasification retorts operating at 1000°F to produce coal liquids and a devolatilized char. The char discharged from the mild gasification retorts is fed along with 500 tons per day of metallurgical grade coal into a hot briquetting system followed by a rotary hearth continuous coking process operating at 2000°F. It is claimed that this process can produce coke in two hours in a completely enclosed system, and produce "high quality" coal liquids acceptable for further refining into transportation fuel blend stock.

The objectives of this demonstration project are to produce metallurgical grade formed coke in two hours and a coal derived liquid transportation fuel in an economically and environmentally acceptable fashion.

PROPOSAL FACT SHEET

Proposer:	Cordero Mining Company
Proposal Title:	Cordero Coal Upgrading Demonstration Project
Technology Category:	New Fuel Form
Coal Type:	Subbituminous (Wyoming, Wyodak Seam)
Project Location:	Gillette, Campbell County, Wyoming
Project Duration:	29 months
Estimated Project Cost:	$34,300,000
Estimated DOE Share:	$17,150,000 (50%)
Estimated Proposer Share:	$17,150,000 (50%)
Additional Team Members:	Carbontec Wyoming, Inc. Stone & Webster Engineering Corporation Dairyland Power Cooperative

Proposal Summary:

The proposed project will demonstrate the Carbontech Syncoal Process to upgrade high moisture, low-sulfur, low-rank coals. This upgraded fuel could be used in power plants designed to burn higher Btu coals, and as a low sulfur fuel for future power generation and industrial facilities.

The new technology consists of a two-stage drying process. The first stage drier uses a mixture of hot fuel oils to drive part of the moisture from the coal. The resulting oil coating also provides a barrier to prevent moisture reabsorption and spontaneous combustion. The second drying step uses hot flue gas to further dry the oil coated coal. The advantage of this process is that it upgrades low rank, low sulfur Western coals, to produce a higher Btu/pound fuel that is moisture-repellent, resistant to attrition and dusting, and resistant to spontaneous combustion.

PROPOSAL FACT SHEET

Proposer:	Custom Coals International, a joint venture between Duquesne Ventures, a subsidiary of Duquesne Light Co., and Genesis Research Corporation
Proposal Title:	Self-Scrubbing Coal: An Integrated Approach to Clean Air
Technology Category:	Coal Preparation
Coal Type:	Bituminous (Sewickley Seam; Pittsburgh No. 8; Illinois No. 5)
Project Location:	Greensboro, Greene County, Pennsylvania; Springdale, Allegheny County, Pennsylvania; Richmond, Wayne County, Indiana
Project Duration:	45 months
Estimated Project Cost:	$76,077,309
Estimated DOE Share:	$38,038,654 (50%)
Estimated Proposer Share:	$38,038,655 (50%)

Additional Team Members:

ICF Kaiser Engineers	CQ, Inc.
Richmond Power & Light Co.	Electric Power Research Institute

Proposal Summary:

The proposed project will demonstrate the "Self-Scrubbing Coal" technology which involves the integration of advanced physical coal cleaning with coal/sorbent reconstitution techniques to produce a utility or large industry fuel which emits less than 1.2 lb SO_2/MMBtu when combusted. Two forms of cleaned coal will be produced including Carefree Coal (i.e., coal that has been aggressively cleaned) and self-scrubbing coal (i.e., Carefree Coal with a limestone based additive).

The technology envelope includes the use of: 1) Genesis Desliming and Genesis Dense Media Cyclones; 2) Micron-Sized magnetite production from waste steel mill pickle liquor; 3) Countercurrent and multistage magnetite recovery circuits; 4) Sorbent addition during pelletization of 105 x 15 micron deep-cleaned coal. The demonstration will produce Self-Scrubbing and Carefree Coal from 250 tons of coal per hour near Duquesne Light Co.'s Greensboro, PA, commercial coal cleaning facility. Tests of the product are to be conducted at Duquesne Light Co.'s 570 MWe Cheswick, PA, and Richmond Power and Light Co.'s 60 MWe Whitewater Valley, IN, stations.

PROPOSAL FACT SHEET

Proposer:	Energy and Environmental Research Corporation
Proposal Title:	Field Evaluation of Advanced Gas Reburning
Technology Category:	Advanced Combustion
Coal Type:	Bituminous (Illinois & Kentucky)
Project Location:	Springfield, Sangamon County, Illinois; Memphis, Shelby County,Tennessee
Project Duration:	54 months
Estimated Project Cost:	$44,178,973
Estimated DOE Share:	$21,493,070 (48.65%)
Estimated Proposer Share:	$22,685,903 (51.35%)

Additional Team Members:

City Water, Light and Power	Illinois Department of Energy & Natural Resources
ANR Pipeline Company	Texas Gas Transmission Corporation
Gas Research Institute	Electric Power Research Institute
Tenneco Gas	Tennessee Valley Authority (TVA)
Memphis Light, Gas and Water	

Proposal Summary:

This project is a field evaluation of an advanced gas reburning (AGR) process, proposed by the Energy and Environmental Research Corporation. The primary candidates for this technology are cyclone-fired utility boilers, which are high-level sources of NO_x (an acid rain precursor) and which have proved intractable to remediation.

In the AGR process, the NO_x level is reduced in two stages by means of a synergistic combination of two known technologies: basic gas reburning (GR) and selective non-catalytic reduction. The first stage of reduction is achieved by injecting natural gas into the boiler in a carefully controlled manner, replacing an equivalent portion of the coal fuel. The second stage of reduction involves a reaction with a solution of urea, a nitrogen-containing reagent. This system improves upon basic GR and is expected to show NO_x reductions similar to selective catalytic reduction but at lower cost.

This project will demonstrate AGR on two cyclone-fired utility boilers. The smaller unit, 33 MWe, is owned by City Water, Light and Power of Springfield, IL. This boiler is being equipped currently for GR and Sorbent Injection for a CCT-I project. The larger unit, 300 MWe, is operated by TVA in Memphis, TN. After baseline and optimization testing, each unit will be operated for twelve months under normal utility conditions in order to provide operating data on AGR for consideration by the utility industry.

PROPOSAL FACT SHEET

Proposer:	Energy and Environmental Research Corporation
Proposal Title:	Coal Fines Slurry - A Clean Fuel from Waste
Technology Category:	Coal Preparation
Coal Type:	Bituminous (Pennsylvania)
Project Location:	Homer City, Indiana County, Pennsylvania
Project Duration:	56 months
Estimated Project Cost:	$132,512,813
Estimated DOE Share:	$ 55,628,878 (41.98%)
Estimated Proposer Share:	$ 76,883,935 (58.02%)
Additional Team Members:	Pennsylvania Electric Company New York State Electric & Gas Corporation (NYSEG) Electric Power Research Institute (EPRI)

Proposal Summary:

This Coal Fines Slurry (CFS) concept was proposed by the Energy and Environmental Research Corporation (EER), along with team members Pennsylvania Electric Company (PENELEC), New York State Electric and Gas Company (NYSEG), and the Electric Power Research Institute (EPRI). CFS is primarily intended for large industrial and utility boilers.

The CFS technology envelope involves the integration of advanced coal cleaning (air sprayed hydrocyclone), CFS preparation, and CFS/pulverized coal co-firing technologies. The demonstration will use the difficult-to-clean 100 x O mesh by-product from conventional coal cleaning operations adjacent to the 1850 MWe Homer City power station. In applications, CFS could be produced from the vast and growing U.S. inventories of waste pond coal fines.

The project objectives are to demonstrate at full-scale, the ability to: produce an advanced beneficiated coal from 100 x O mesh fines which is difficult to clean with existing conventional cleaning technology; produce a high solids loading, low chemical additive coal fines slurry; and co-fire CFS (21%) with pulverized coal in two 600 MWe boilers.

The demonstration seeks to obtain all pertinent performance data in each of these areas in order to commercialize the CFS technology while utilizing waste fines and lowering SO_2 emissions from power generating facilities.

PROPOSAL FACT SHEET

Proposer:	Energy Resources and Logistics, Inc.
Proposal Title:	The Greenbrier Coal Diesel Combined Cycle
Technology Category:	Coal Preparation
Coal Type:	Bituminous (Central Appalachian)
Project Location:	White Sulphur Springs, Greenbrier County, West Virginia
Project Duration:	72 months
Estimated Project Cost:	$66,700,000
Estimated DOE Share:	$33,350,000 (50%)
Estimated Proposer Share:	$33,350,000 (50%)
Additional Team Members:	Constellation Energy, Inc.

Proposal Summary:

The Greenbrier Coal Diesel Combined Cycle (CDCC) project was proposed by Energy Resources & Logistics, Inc. (ER&L) in conjunction with Constellation Energy, Inc. (CEI). The CDCC is a cogeneration technology for use at the 25-100 MWe scale while simultaneously providing steam and hot water. The CDDC concept seeks high thermal efficiencies while emitting exceedingly low levels of SO_2, NO_x, and particulates.

The CDCC concept involves the integration of a number of technologies which must be integrated on-site at the Greenbrier Facility. Technologies include 1) advanced physical coal cleaning; 2) coal water slurry (CWS) manufacture; 3) power generation from CWS-fired and oil-fired diesel engines; 4) micronized coal combustion with diesel effluent (ca. 12% O_2) for steam production (900°F, 900 psig) and use in turbine generators; 5) selective catalytic reduction (SCR) for NO_x reduction; 6) spray dryer for SO_2 control; and 7) baghouse for particulate control.

The CDCC demonstration will produce 25 MWe of electricity for sale to a local public utility as well as 30,000 lb/hr of steam and 12,000 gal/hr of hot water at 160°F for space heating at the Greenbrier resort facility in White Sulphur Springs, West Virginia. The objectives of the proposed project are to demonstrate the economics of the use of CWS on one of the five diesels and on the boilers, and to produce a plan to convert the remaining diesels from oil to CWS if it proves to be economically attractive.

PROPOSAL FACT SHEET

Proposer:	Freetown Energy Park
Proposal Title:	Freetown Energy Park
Technology Category:	Integrated Gasification Combined-Cycle
Coal Type:	Bituminous (U.S. Eastern)
Project Location:	Freetown, Bristol County, Massachusetts
Project Duration:	99 months
Estimated Project Cost:	$845,000,000
Estimated DOE Share:	$150,000,000 (17.8%)
Estimated Proposer Share:	$695,000,000 (82.2%)
Additional Team Members:	Texaco Syngas, Inc. General Electric Co. COM/Energy Freetown Realty

Proposal Summary:

The Freetown Energy Park project is an integrated gasification combined-cycle (IGCC) 440 MWe power generation system. The project is being developed by a consortium of Texaco Syngas Inc., COM/Energy Freetown Realty, and General Electric Co.

The IGCC system uses two parallel Texaco oxygen-blown entrained coal gasification trains with full quench. The system will consume a total of 4088 short tons per day of eastern coal. For the most part, the plant operates with sub-systems in parallel trains. The overall system, as described, will utilize cold gas stream cleanup for both sulfur (97.5% recovery) and particulate removal (wet scrubbing). Cold gas recovery of sulfur (Claus technique) produces a salable sulfur product. NO_x generation is minimized (<25 ppm) by using gas moisturization and/or steam injection techniques in the fuel gas combustion process. A syngas turbine expander produces an additional 12.8 MWe of power and facilitates the operation of the gasifier at a higher pressure. Following expansion and cleanup, the fuel gas is saturated and sent to a gas turbine generator set for power production. Solid wastes from the process are non-hazardous, and easily disposed. Advantages of this project include the readiness of the technology and the superior reduction in emissions. The demonstration project will have a heat rate of 9100 Btu/kWh.

Based on the readiness of the technology, the objective of this project is to show that a commercial scale IGCC system can be economically and environmentally effective in the utility market place.

PROPOSAL FACT SHEET

Proposer:	Frontier Energy Corporation
Proposal Title:	Conversion of High Sulfur Ohio Coal and Heavy Oil to High Quality, Clean Liquid Fuels via the CCLC Co-Processing Technology, A Demonstration Project
Technology Category:	New Fuel Form
Coal Type:	Bituminous (Ohio #6)
Project Location:	Painesville Township, Lake County, Ohio
Project Duration:	72 months
Estimated Project Cost:	$440,000,000
Estimated DOE Share:	$100,000,000 (22.7%)
Estimated Proposer Share:	$340,000,000 (77.3%)
Additional Team Members:	Canadian Energy Development, Inc. Kilbourn Engineering, Inc.

Proposal Summary:

Frontier Energy Corporation and its licensor, Canadian Energy Development, Inc., proposed to demonstrate the CCLC technology (acronym not defined), developed by Gesellschaft fur Kohleverflussigung (GfK) in Germany, which entails the co-processing of high sulfur coal and heavy oil to produce low sulfur fuel oil, naphtha and cogeneration of electric power. Other by-products such as LPG, elemental sulfur and ammonia are also produced.

This coprocessing technology is a two-stage direct liquefaction approach. It includes a novel countercurrent flow reactor for the first or primary upgrading unit, followed by a mixed phase fixed bed catalytic hydrotreater. Other unit operations are associated with the two main processing steps including liquid fractionation, naphtha upgrading, hydrogen production, coal/oil slurry preparation, gas and water cleaning, and cogeneration of electricity using fluidized-bed combustion of residue material. Advantages of this technology are production of environmentally acceptable fuels, by-products, i.e., ammonia, sulfur and electricity from a high sulfur feed coal and heavy petroleum liquid in an integrated plant. Claimed plant operation advantages of the technology include parallel primary upgrading, reactor vessels, low recycle hydrogen rates, low reactant preheat required and internal gravity separation of light and heavy products in the Primary Upgrader.

The objective of this demonstration project is to prove the practicality of CCLC technology in a continuous, integrated plant. The demonstration project site is Painesville Township, Ohio, and will process 1,200 tons per day of Ohio No. 5 or No. 6 coal and 20,000 barrels/day of Alberta heavy oil.

PROPOSAL FACT SHEET

Proposer:	Geneva Steel
Proposal Title:	COREX Ironmaking Process Demonstration Plant Proposal
Technology Category:	Industrial
Coal Type:	Bituminous (Low Sulfur Western)
Project Location:	Vineyard Town, Utah County, Utah
Project Duration:	60 months
Estimated Project Cost:	$467,546,614
Estimated DOE Share:	$120,159,480 (25.7%)
Estimated Proposer Share:	$347,387,134 (74.3%)
Additional Team Members:	Bechtel Corporation Deutsche Voest-Alpine Industrieanlagenbau GmbH (DVAI)

Proposal Summary:

Geneva Steel proposes to demonstrate the COREX ironmaking process which is capable of producing steel while reducing environmental emissions and production costs. The commercial scale demonstration plant, to be located at Geneva's plant site 45 miles south of Salt Lake City, Utah, would be capable of producing iron from a wide range of domestic iron ores and coals.

The COREX process consists of a counter-current hot gas flow, moving bed, direct reduction shaft furnace connected to a lower oxygen-blown melter gasifier. Sponge iron and a medium Btu export gas are produced in the reduction shaft furnace from iron bearing materials charged into the reactor that are reduced by gases produced in the lower melter gasifier. The sponge iron is melted in the melter gasifier and is tapped as hot, flowing metal. The high temperatures in the melter gasifier cause cracking of the hydrocarbons formed during coal devolatization with the result that tars and air toxics associated with conventional cokemaking are essentially eliminated. Emissions are further reduced by enclosing the coal and iron ore feeds within the COREX unit. This process alleviates environmental concerns associated with conventional cokemaking processes.

The objective of the project is to construct and operate, for demonstration purposes, a 770,000 tons per year COREX process ironmaking plant. The demonstration plant will provide the domestic steel industry with technical, environmental, and economic information necessary to make corporate decisions on further scale-up and/or utilization of the COREX process.

PROPOSAL FACT SHEET

Proposer:	Heartland Fuels Corporation
Proposal Title:	K-Fuel[tm] Commercial Demonstration Project
Technology Category:	New Fuel Form
Coal Type:	Subbituminous (Powder River Basin)
Project Location:	Gillette, Campbell County, Wyoming
Project Duration:	49 months
Estimated Project Cost:	$88,359,677
Estimated DOE Share:	$44,179,838 (50%)
Estimated Proposer Share:	$44,179,839 (50%)
Additional Team Members:	WPL Holdings, Inc. Heartland Development Corporation Enserv, Inc. RMT, Inc. FRU-CON Construction Corporation/FRU-CON Engineering, Inc. K-Fuel@ Partnership State of Wyoming

Proposal Summary:

Heartland Fuels Corporation and its principal shareholders, ENSERV Inc., a wholly-owned subsidiary of Heartland Development Corporation, which is the holding company of WPL Holdings, Inc., and K-Fuel[tm] Partnership proposed to demonstrate the K-Fuel[tm] technology on a commercial scale. This technology entails the upgrading of low-rank coals by pressurized steam treatment to produce a low-moisture, high energy density solid fuel.

The proposed technology, in its latest version, includes two batch operated swinging pressurized processors in which high temperature saturated steam enters in contact with the low-rank coals, and transforms them into a low-moisture, high energy density solid fuel, called K-Fuel[tm]. The thermal reaction removes oxygen-bearing groups from the coal to make it more hydrophobic. In addition, a mild pyrolysis takes place producing some tars and solid bitumen. Both tar and bitumen coat the K-Fuel[tm], which contributes to higher hydrophobicity and aids in the subsequent pelletizing step. In its final form, K-Fuel[tm] should be a stable, pelletized, low-moisture, low sulfur, low ash, high energy density, solid fuel which should compete with eastern/central bituminous coals in the midwestern and western U.S. markets.

PROPOSAL FACT SHEET

Proposer:	Iowa Power, Inc.
Proposal Title:	Des Moines Energy Center Advanced PCFB Demonstration Project
Technology Category:	Fluidized-Bed Combustion
Coal Type:	Subbituminous (Western)
Project Location:	Pleasant Hill, Polk County, Iowa
Project Duration:	124 months
Estimated Project Cost:	No Amounts Provided in Public Abstract
Estimated DOE Share:	46.7%
Estimated Proposer Share:	53.3%
Additional Team Members:	Black & Veatch Pyropower Corporation

Proposal Summary:

Iowa Power, Inc., has proposed to demonstrate Pyropower Corporation's (Pyropower) second generation Pressurized Circulating Fluidized-Bed Combustion (PCFBC) technology. The demonstration will be in a utility mode of operation at Iowa Power, Inc.'s Des Moines Energy Center located in Pleasant Hill, Iowa.

Pyropower is offering a second generation PCFBC system comprised of a CFB boiler with a mild topping combustor system. The fuel gas for the mild topping combustor will be produced by a 1800°F PCFB Carbonizer. Second generation PCFBC is a coal-fired combined cycle power generation system. In second generation concepts the inlet temperature to the combined cycle gas turbine is not limited to the outlet temperature of the fluidized-bed combustor. The inlet temperature is restricted only by the materials of construction used to fabricate the gas turbine. In the mild topping demonstration, the inlet turbine temperature will be increased to 1750°F, or 100°F above the fluidized-bed outlet temperature. This inlet temperature limit restricts power production from the gas turbine generator to 20% of the combined-cycle output.

The objective of the project is to demonstrate mild topping of a first generation PCFBC at 150 MWe utility scale. Data obtained from this demonstration will be used to scale-up to utility size systems on the order of 500 MWe.

PROPOSAL FACT SHEET

Proposer:	Leas Industrial Associates
Proposal Title:	Combined Coal and Limestone Process
Technology Category:	New Fuel Form
Coal Type:	Bituminous (Indiana, Illinois, and Ohio)
Project Location:	Mount Vernon, Posey County, Indiana
Project Duration:	30 months
Estimated Project Cost:	$30,000,000
Estimated DOE Share:	$15,000,000 (50%)
Estimated Proposer Share:	$15,000,000 (50%)
Additional Team Members:	None

Proposal Summary:

Leas Industrial Associates has proposed to demonstrate a clean syn-coal and lime production technology. The application of the proposed technology is to produce a lowered sulfur char fuel (syn-coal) and large quantities of lime, along with various by-products.

The technology is based on a modification of catalytic cracking technology. Coal and a refractory recycle material are cycled through a reactor consisting of three loops. The first loop pyrolyzes the coal, and with added lime, results in a low sulfur char. The second and third loops produce low and medium Btu gas. The process generates its own lime from limestone. It also produces various lime-based products and a 'heavy' metal concentrate, presumably from volatile metals in the coal. Advantages of the process include production of lime, lowered sulfur char fuel, pyrolysis gas and a 'heavy' metal concentrate.

The proposed demonstration project is a 1,000 tons/day plant to be located in Mount Vernon, Indiana. The project will use Indiana, Illinois, and Ohio coals.

PROPOSAL FACT SHEET

Proposer:	Lin Technologies, Inc.
Proposal Title:	Improved Lin SO_x/NO_x Removal and Waste Products Utilization Process
Technology Category:	Flue Gas Cleanup
Coal Type:	Bituminous (Indiana)
Project Location:	Richmond, Richmond County, Indiana
Project Duration:	30 months
Estimated Project Cost:	$4,437,820
Estimated DOE Share:	$1,924,660 (43.4%)
Estimated Proposer Share:	$2,513,160 (56.6%)
Additional Team Members:	Richmond Power & Light Co. Ohio Department of Transportation Bronson Plating Company

Proposal Summary:

Lin Technologies, Inc., proposed to design, construct, and operate a flue gas cleanup (FGC) plant to remove both SO_2 and NO_x from a 3-MWe slip stream of flue gas at the Richmond Power & Light Co., Richmond, Indiana. Other team members will be involved with the characterization and testing of the Linfan by-product formed in the process.

The process can be briefly described as follows. The flue gas, after passing through the existing electrostatic precipitator (ESP), is split into two streams. One stream is directed through a catalytic oxidation converter. The streams are recombined at the downstream side of the catalytic converter and then enter a fluidized lime absorber. Over 95% of the SO_x is converted to $CaSO_4$. The mixture of unreacted CaO and $CaSO_4$ is referred to as Linfan, the bulk of which is recovered from the water used to cool the gas. The NO_x at the lower temperature, in the presence of steam, reacts with the entrained sorbent to form $Ca(NO_3)_2$. This product and any remaining particulate matter are removed using a fabric filter prior to exiting through the stack.

The goal of this project is to achieve 95% SO_x and 50% NO_x removal while maximizing utilization of the CaO. In order to minimize solid waste disposal problems, the proposer plans to demonstrate that the by-product, Linfan, has diversified uses in areas such as concrete production, plastering material manufacture, wastewater treatment, and fly ash stabilization.

PROPOSAL FACT SHEET

Proposer:	Manitowoc Public Utilities
Proposal Title:	Manitowoc Advanced Energy Demonstration Project
Technology Category:	Fluidized-Bed Combustion
Coal Type:	Bituminous (Illinois #6)
Project Location:	Manitowoc, Manitowoc County, Wisconsin
Project Duration:	90 months
Estimated Project Cost:	$249,789,631
Estimated DOE Share:	$124,894,815 (50%)
Estimated Proposer Share:	$124,894,816 (50%)

Additional Team Members:

Foster Wheeler-USA
Foster Wheeler Energy Corporation
Westinghouse Power Generation
Westinghouse Science and Technology Center
Foster Wheeler Development Corp.
Foster Wheeler Constructors, Inc.

Proposal Summary:

Manitowoc Public Utilities has proposed a demonstration of the second generation pressurized fluidized-bed combustion (PFBC) technology being developed by Foster Wheeler Corporation. The demonstration will be for the cogeneration mode of power production. The site is Manitowoc Public Utilities' power station located on the western shore of Lake Michigan within the city limits of Manitowoc, Wisconsin.

Foster Wheeler is offering an advanced or second generation PFBC system combining carbonization and pressurized circulating fluidized-bed combustion (PCFBC). Coal is fed to a pressurized fluidized-bed partial gasifier or Carbonizer which produces a low-Btu gas and char. The char is burned in a PCFBC, and the air rich flue gas is cleaned of particulates and sent to the topping combustor. Low-Btu fuel gas from the partial gasifier is also cleaned and piped to the topping combustor. The topping combustor in the second generation demonstration is designed to achieve a turbine inlet temperature of 1975°F consistent with a modern 37 MWe gas turbine.

The objective of this project is to secure a low cost power production capability to serve Manitowoc Public Utilities' customers, while demonstrating a commercial scale Foster Wheeler second generation PFBC system. Data obtained from this demonstration will be used to scale up to larger utility size systems on the order of 300 MWe. In these larger systems gas turbine inlet temperatures will approach 2350°F.

PROPOSAL FACT SHEET

Proposer:	New York State Electric & Gas Corporation
Proposal Title:	Milliken Clean Coal Technology Demonstration Project
Technology Category:	Flue Gas Cleanup
Coal Type:	Bituminous (Pittsburgh Seam)
Project Location:	Lansing, Tompkins County, New York
Project Duration:	75 months
Estimated Project Cost:	$158,607,807
Estimated DOE Share:	$ 64,553,377 (40.7%)
Estimated Proposer Share:	$ 94,054,430 (59.3%)
Additional Team Members:	Consolidation Coal Company Saarberg-Holter Umwelttechnick Gmbh Stebbins Engineering & Manufacturing Co.

Proposal Summary:

The proposed project will demonstrate a combination of cost effective, emission reduction, and efficiency improvement technologies that will allow utilities to comply with the Clean Air Act Amendments of 1990. Reduction of sulfur dioxide and nitrogen oxides will be obtained at a reduced cost with minimal impact on station efficiency or heat rate.

The Saarberg-Holter-Umwelttechik GMBH (S-H-U) flue gas desulfurization process is a formic acid-enhanced wet limestone scrubber technology that will demonstrate 98% SO_2 removal and energy consumption, production of commercial grade gypsum, with high system reliability. In the S-H-U process, flue gas is subjected to both concurrent and countercurrent limestone slurry sprays. Flue gas desulfurization takes place in a Stebbins Engineering and Manufacturing Co.'s tile-lined split module absorber. The tile lining will provide lower life cycle costs and reduced maintenance problems due to the superior corrosion and abrasion resistance of the tile. The split module design will provide greater operational flexibility for the two demonstration generating units than a single absorber module, and will have lower capital and space requirements than two stand-alone modules. The NO_xOUT injection system provided by NALCO Fuel Tech is a low capital cost energy efficient method of decreasing NO_x emissions by urea injection into the boiler flue gas. The heat-pipe air heater system will be installed to combine the benefits of a heat-pipe air heater with advanced temperature controls to reduce air in-leakage and to allow reduction in the air heater flue gas exit temperatures.

PROPOSAL FACT SHEET

Proposer:	Pedco Incorporated
Proposal Title:	Industrial/Municipal Energy & Waste Management Program
Technology Category:	Advanced Combustion
Coal Type:	Bituminous (Eastern or Coal Waste)
Project Location:	Elizabethton, Carter County, Tennessee; Cincinnati, Hamilton County, Ohio; Erie, Erie County, Pennsylvania
Project Duration:	36 months
Estimated Project Cost:	$53,058,910
Estimated DOE Share:	$25,468,277 (48.0%)
Estimated Proposer Share:	$27,590,633 (52.0%)

Additional Team Members:

East Tennessee University
North American Rayon Corporation
Zurn Industries, Inc.
State of Ohio
State of Tennessee
State of Pennsylvania
Southeastern Regional Biomass Energy Program
The First Tennessee Development District
Carter County, Tennessee
Johnson County, Tennessee
Unicoi County, Tennessee
Washington County, Tennessee
The City of Elizabethton, Tennessee
The City of Johnson City, Tennessee
Tennessee Technological University

Proposal Summary:

This project was proposed by Pedco Incorporated, in cooperation with North American Rayon Corporation (NARC), and Zurn Industries, Inc. The existing boilers at NARC's production plant in Elizabethton, TN, will be replaced by rotary cascading bed boilers (RCBB) having the capability of burning many different fuels, including high-sulfur coals, anthracite culm, shredded tires and refuse derived fuel (RDF).

The rotary combustor was developed by Pedco Incorporated as an incinerator, at very small capacity, and then scaled up to a 5,000 lbs/hr boiler; subsequently, this was modified to operate at 10,000 lbs/hr. This RCBB, operating currently as a test unit at NARC, provides the basis for the design of eight 60,000 lbs/hr boilers comprising the core of the demonstration project. Pedco Incorporated proposes to provide the associated ash handling facility and equipment to store and handle the coal, RDF, sludges, etc. One of the benefits of the demonstration would be a significant reduction in cost of fuel for NARC.

PROPOSAL FACT SHEET

Proposer:	Pure Air, On the Lake, L.P.
Proposal Title:	Co-Current Super Scrubber
Technology Category:	Flue Gas Cleanup
Coal Type:	Bituminous
Project Location:	Near Johnstown, Indiana County, Pennsylvania
Project Duration:	75 months
Estimated Project Cost:	$244,983,000
Estimated DOE Share:	$ 68,595,000 (28.0%)
Estimated Proposer Share:	$176,388,000 (72.0%)
Additional Team Members:	Pennsylvania Electric Company Electric Power Research Institute (EPRI) Radian Corporation

Proposal Summary:

Pure Air, On the Lake, L.P. proposed a Co-current Super Scrubber flue gas desulfurization project at the Conemaugh Station operated by the Pennsylvania Electric Company, and located near Johnstown, PA. Pure Air is a general partnership between Air Products and Chemicals, Inc. and Mitsubishi Heavy Industries America, Inc. Four scrubber modules will service the Conemaugh Station's two 900MWe boilers.

The technology is a wet limestone scrubber utilizing the co-current flow configuration as practiced by Pure Air/MHI, coupled with the EPRI-Radian enhancements of a gridless design and an advanced chemical additive program. Up to 99% SO_2 removal is expected at reduced parasitic power consumption. A reduced pressure drop across the absorber is projected by removal of the conventional packing internals, while SO_2 removal is maintained or improved by use of chemical additives that enhance absorption.

The objective is to demonstrate superior SO_2 absorption at a commercially reliable scale with increased operational flexibility and a lower capital cost than conventional flue gas desulfurization systems.

PROPOSAL FACT SHEET

Proposer: The Ralph M. Parsons Company

Proposal Title: Parsons FGC Process

Technology Category: Flue Gas Cleanup

Coal Type: Bituminous

Project Location: St. Marys, Auglaize County, Ohio

Project Duration: 54 months

Estimated Project Cost: $40,800,000

Estimated DOE Share: $20,400,000 (50.0%)

Estimated Proposer Share: $20,400,000 (50.0%)

Additional Team Members:

St. Marys Municipal
Ohio Coal Development Office
Columbia Gas System Service Corporation
Gas Research Institute
Consolidated Natural Gas Service Company, Inc.
Exxon Research and Engineering Company
Energy and Environmental Research Company

Proposal Summary:

The Ralph M. Parsons Company proposed to design, construct and operate a flue gas cleanup (FGC) plant to remove both SO_2 and NO_x from flue gas produced at a 10-MWe coal-fired municipal power plant located in St. Marys, Ohio. Energy and Environmental Engineering Research Company of Irvine, CA, will act as subcontractor to provide expertise in the field of oxygen-controlled combustion.

The Parsons FGC process utilizes catalytic reduction to potentially reduce SO_2 and NO_x emissions by 99% and 95%, respectively. Boiler flue gas first passes through a catalytic hydrogenerator, where a reducing gas - hydrogen, produced by steam reforming of methane - converts SO_2 to H_2S and NO_x to N_2. The resultant gas then passes through the existing electrostatic precipitator (ESP) and enters a desuperheater, where it is cooled and dried by condensation. The desuperheater effluent enters an absorption column containing an H_2S-selective solvent, which absorbs essentially all of the H_2S from the flue gas. The absorber effluent gas contains less than 10 ppm of H_2S and is vented to the atmosphere. The H_2S-containing solution passes through a regenerator, and the H_2S-rich offgas is sent to a sulfur plant for recovery of elemental sulfur for sale. Essentially no solid wastes are produced, liquid waste streams are minimal, and there are no airborne particulate emissions.

PROPOSAL FACT SHEET

Proposer:	Sierra Pacific Power Company
Proposal Title:	Piñon Pine Power Project
Technology Category:	Integrated Gasification Combined-Cycle
Coal Type:	Bituminous
Project Location:	near Reno, Storey County, Nevada
Project Duration:	104 months
Estimated Project Cost:	$340,726,600
Estimated DOE Share:	$170,363,300 (50%)
Estimated Proposer Share:	$170,363,300 (50%)
Additional Team Members:	Foster Wheeler USA Corporation The MW Kellogg Company

Proposal Summary:

The proposed project is to design, construct, and operate a new 80 MWe IGCC plant which will incorporate an air-blown KRW fluidized-bed gasifier producing a low-Btu gas which is used as fuel in a combined-cycle power plant. The gasification system also includes hot gas removal of particulate and sulfur compounds from the fuel gas resulting in exceptionally low atmospheric emissions. Desulfurization is accomplished by a combination of limestone injection into the fluidized-bed gasifier and by external zinc ferrite fixed-bed desulfurization reactors. Particulate removal is accomplished by high efficiency cyclones and a barrier filter. The demonstration project will have an estimated heat rate of 9500 Btu/kWh.

The objective of the project is to demonstrate that integrated coal gasification combined-cycle power plants can be built at capital costs and thermal efficiencies which significantly reduce electric power costs relative to conventional technologies. The project will also demonstrate the effectiveness of hot gas cleanup in achieving a negligible environmental impact for low sulfur western coals.

PROPOSAL FACT SHEET

Proposer:	TAMCO Power Partners, a general partnership between Tampella Power Corporation and Coastal Power Production Company
Proposal Title:	Toms Creek IGCC Demonstration Project
Technology Category:	Integrated Gasification Combined-Cycle
Coal Type:	Bituminous (Virginia)
Project Location:	near Coeburn, Wise County, Virginia
Project Duration:	81 months
Estimated Project Cost:	$219,100,000
Estimated DOE Share:	$109,000,000 (49.7%)
Estimated Proposer Share:	$110,100,000 (50.3%)
Additional Team Members:	Stone & Webster Engineering Corporation Institute of Gas Technology

Proposal Summary:

The proposed project will demonstrate an integrated gasification combined-cycle (IGCC) process consisting of an air-blown, fluidized-bed gasifier (Tampella U-Gas), gas cooler/steam generator, and hot gas cleanup in combination with a GE MS 6001 gas turbine modified for use with either a low-Btu gas or natural gas and a conventional steam bottoming cycle. The plant will use 430 tons per day of locally mined bituminous coal to produce 55 MWe of power from a coal-gas fired gas turbine. A total 107 MWe of power will be delivered to the electric grid at the completion of the project. The power will be produced from two gas turbines (net power 67 MWe), one coal-gas fired and one natural gas fired, and an additional 40 MWe net from the steam turbine. In addition, 20,000 pounds per hour of steam will be exported to a nearby coal preparation plant. Sulfur removal is accomplished in two steps. Dolomite is used for in-bed gasifier sulfur capture and down-stream cleanup is accomplished in a fluidized-bed of regenerative zinc titanite. Particulate cleanup, before the gas turbine, will be performed by high temperature candle filters (1,000^{0}F). The demonstration plant heat rate is estimated to be 8700 Btu/kWh.

PROPOSAL FACT SHEET

Proposer:	Tennessee Valley Authority
Proposal Title:	Coproduction of Electricity and Fertilizer
Technology Category:	*Integrated Gasification Combined-Cycle*
Coal Type:	Bituminous (Illinois or Western Kentucky)
Project Location:	Saltillo, Hardin County, Tennessee
Project Duration:	129 months
Estimated Project Cost:	$686,000,000
Estimated DOE Share:	$180,000,000 (26.2%)
Estimated Proposer Share:	$506,000,000 (73.8%)
Additional Team Members:	None

Proposal Summary:

The Tennessee Valley Authority proposes to build and operate an integrated gasification combined-cycle (IGCC) plant to coproduce electricity and fertilizer. The objective of the project is to demonstrate an optimal configuration of an IGCC/fertilizer plant operating in an environmentally superior manner, relative to current commercially available technology. The technology to be used is an entrained-bed coal gasifier (using wet or dry coal feed) producing medium-Btu gas. The resultant syngas will serve as both a fuel for a high temperature (2350°F) GE combustion turbine and as a chemical feed stock for the production of fertilizer. The process will produce from 151 to 244 MWe of power (depending on the volume of syngas diverted to the fertilizer plant), up to 1000 tons per day (TPD) of fertilizer (urea), and about 300 TPD of sulfuric acid.

The advantages of demonstrating the IGCC and IGCC/F processes are that SO_x and NO_x emissions as well as solid waste disposal will be reduced. The high efficiency of the IGCC process will reduce CO_2 emissions from the power cycle. CO_2 from the syngas stream will also be used in the urea coproduction, further reducing CO_2 emissions. The coproduction of electricity and fertilizer will allow utilities to repower or replace existing power plants and provide economic benefits through the sale of value-added fertilizer and acid coproducts. It will give the opportunity to continuously operate the gasification system at 100% capacity while allowing for load swings as the power load or fertilizer coproduct demand changes.

PROPOSAL FACT SHEET

Proposer:	Tennessee Valley Authority
Proposal Title:	Micronized Coal Reburning Demonstration for NO_x Control on A 175-MWe Wall-Fired Unit
Technology Category:	Advanced Combustion
Coal Type:	Bituminous (Eastern Low-Sulfur)
Project Location:	Near Paducah, McCracken County, Kentucky
Project Duration:	48 months
Estimated Project Cost:	$7,330,000
Estimated DOE Share:	$3,515,000 (48.0%)
Estimated Proposer Share:	$3,815,000 (52.0%)
Additional Team Members:	MicroFuel Corporation R-C Environmental Services and Technologies Duke/Fluor Daniel

Proposal Summary:

The proposed project will demonstrate the reduction of NO_x emissions by the retrofit of coal reburning to a pulverized coal, wall-fired boiler on an existing 175 MWe wall-fired unit at the Shawnee Fossil Plant near Paducah, Kentucky.

The coal at the new demonstration site (a low sulfur, bituminous coal from eastern Kentucky or West Virginia) will be employed as the reburn fuel; however, it will be micronized (80% below 325 mesh). Up to 30% of the total fuel fired in the furnace will be micronized size. An incidental benefit, at TVA's Shawnee site, will be the restoration of the total mill capacity to the original 175 MWe. Currently, a mill capacity limitation exists due to the use of a coal differing substantially from the design coal.

PROPOSAL FACT SHEET

Proposer:	ThermoChem, Inc.
Proposal Title:	Demonstration of Pulse Combustion in an Application for Steam Gasification of Coal
Technology Category:	Advanced Combustion
Coal Type:	Subbituminous (Wyodak Seam)
Project Location:	Springfield, Lane County, Oregon
Project Duration:	60 months
Estimated Project Cost:	$37,333,473
Estimated DOE Share:	$18,666,736 (50.0%)
Estimated Proposer Share:	$18,666,737 (50.0%)
Additional Team Members:	Weyerhaeuser Paper Company Manufacturing and Technology Conversion International, Inc. (MTCI) Engineering Services, Inc. Amax Coal Sales

Proposal Summary:

The proposed project will demonstrate Manufacturing and Technology Conversion International, Inc.'s (MTCI) pulse combustor in an application for steam gasification of coal. This gasification process will produce a medium Btu-content fuel gas from subbituminous coal at Weyerhaeuser Paper Company's Container Board Division mill in Springfield, Oregon. The fuel gas and by-products team produced by this demonstration unit will be used in the mill to offset use of existing hog-fuel boilers. The eventual replacement of all five existing hog-fuel boilers is contemplated.

The demonstration unit will be an industrial size gasifier. The heat required for the gasification will be supplied by the combustion of cleaned gasification products (fuel gas) in numerous pulsed combustion tubes. The products of pulsed combustion are separated from the gasification products. Since no dilution of the gasified fuel gas occurs, a medium Btu-content fuel (500 Btu/scf) gas will be produced. The turbulent nature of the pulsed combustor contributes to a high heat release and high heat transfer rates to the gasifier bed. The fluidized-bed coal gasifier also offers high turbulence and heat transfer rates. The high heat transfer rates on both sides of the pulsed combustion tubes will reduce the amount of heat transfer area required and result in a compact design.

PROPOSAL FACT SHEET

Proposer:	Union Carbide Chemicals and Plastics Company, Inc.
Proposal Title:	Demonstration of the Union Carbide CANSOLV Process at the ALCOA Generating Corporation Warrick Power Plant
Technology Category:	Flue Gas Cleanup
Coal Type:	Bituminous (Squaw Creek Mine, Indiana)
Project Location:	near Newburgh, Warrick County, Indiana
Project Duration:	42 months
Estimated Project Cost:	$32,700,000
Estimated DOE Share:	$16,350,000 (50.0%)
Estimated Proposer Share:	$16,350,000 (50.0%)
Additional Team Members:	ALCOA Generating Corporation Stone & Webster Engineering Corporation

Proposal Summary:

In this project a 75 MWe CANSOLV regenerable flue gas desulfurization system will be designed, constructed, and operated at the ALCOA Generating Corporation Warrick Power Plant near Newburgh, Indiana. The process is designed to operate as an in-duct scrubber system. The retrofit scrubber facility will be installed in one of two flue gas ducts for an existing 150 MWe boiler.

The CANSOLV process is a regenerable system that removes SO_2 from the flue gas stream by contact with an aqueous amine absorbent. The absorbent is regenerated thermally in a separate unit and a slipstream is treated to prevent the build-up of impurities. The SO_2 is recovered as liquid SO_2 for conversion to marketable products. No additional solid or liquid wastes are generated with this process and less space is required than for conventional limestone scrubbing.

PROPOSAL FACT SHEET

Proposer:	Wabash River Coal Gasification Project Joint Venture, a joint venture between Destec Energy, Inc. and PSI Energy, Inc.
Proposal Title:	Wabash River Coal Gasification Repowering Project
Technology Category:	*Integrated Gasification Combined-Cycle*
Coal Type:	Bituminous (Illinois Basin High-Sulfur)
Project Location:	West Terre Haute, Vigo County, Indiana
Project Duration:	69 months
Estimated Project Cost:	$591,927,376
Estimated DOE Share:	$242,690,224 (41.0%)
Estimated Proposer Share:	$349,237,152 (59.0%)
Additional Team Members:	Dow Engineering Co. Sargent & Lundy Engineers

Proposal Summary:

The proposed project will demonstrate a nominal 265 MWe (net) integrated gasification combined-cycle (IGCC) power plant. The project will be used to repower one of six units at PSI's Wabash River Generating Station in West Terre Haute, Indiana.

The IGCC system is based on an oxygen-blown, two-stage entrained coal gasifier, developed by the Dow Chemical Company, using about 2500 tons per day of high sulfur eastern bituminous coal. The demonstration plant will use a high pressure boiler (syngas cooler) to drop gas temperatures from the gasifier outlet (1900^{0}F) to the 450^{0}F needed for warm particulate removal and low temperature acid gas removal. Consistent with IGCC technology, this demonstration plant will have very low environmental emissions (greater than 98% sulfur removal and greater than 90% NO_x removal) and will produce a slag that is inert. The slag will be sold as a by-product along with the sulfur produced. The resultant medium-Btu syngas will be burned in a Turbo Power and Marine combustion gas turbine rated at about 198 MWe. A heat recovery steam generator and steam power generating turbine will produce an additional 104 MWe of electricity. The demonstration plant heat rate will be 8740 Btu/kWh.